The Trades-Man's Help.

An Introduction to

Arithmetick,

Both Vulgar, Decimal, and Instrumental;

With the use of a New Instrument,

CALLED

The Jointed Sliding-Rule.

And also a perpetual *Almanack*, shewing the day of the Month, change of the Moon, *&c.* With Directions for the making of *Bonds*, *Bills*, *Wills*, and other things of Note.

By *Joseph Selden*, Student in Mathematicks.

London, Printed for the Author, and sold by him at *Tunbridge-wells*, and by *Richard Wilkin* at the *Kings head* in St. *Paul's* Church-Yard, 1694.

To the Ingenious

Reader.

AS in this Work all along I have observed Brevity, so here I shall not desist from that Rule; whereupon I shall omit the long Preamble of an Apology: nor shall I be careful in answering the many Objections which may be made by many Criticks of this Mercurial Age, wherein I might spend time, and waste paper, and to no use; for I dare presume, that there is no work or thing so accurately done, but there may be some Objections found: And therefore I cannot conceive that this my little Manual should pass Scot-free. However, I recommend it to the friendly

ingenuous well-wishers of Art, and with them I leave it to make an Apology for its self, or else submit to their affable Censures. As for others, whose churlish Natures cannot dissence with any thing but what proceeds from their Arbitrary Wills; so that if they find any thing that comes beneath, or is but equal to what their lofty Minds conceive, then they scoff at the meanness of it; or are envious, and cannot abide it should be revealed to others; but if it exceed what their envious Intellect doth conceive, then they are angry that any one should exceed them, thinking that they may have knowledge enough already; and what is further discoursed, is to them accounted superfluous and needless; and from such this little Treatise is excluded; and to them as I owe none, so I pay no Respects; since I am not obliged to them for any thing that is here written, or discovered. I hope I may make bold to publish what is my own, not that I desire to detract from any Man his due and right, and ascribe it to my self; for I most willingly acknowledge my self to be obliged to those generous Men that have been pleased to deliver their selves in writing,

from

from whose Works I have observed several things of note. As for Arithmetick, there are several have treated very largely. And as for the Sliding-Rule, it hath been variously contrived, and severally applied; but to my knowledge, none as yet have so compos'd it, as that it may be useful for the intention for which a Sliding-Rule is necessary; and also to be so familiar and easy, to take dimensions with, according to the customary method, as the general Jointed Rule is; neither so proper for Trades-men to work with, as the aforesaid Jointed Rule. Therefore, for these Reasons I have directed my Thoughts to the composing of it; so as that it might be convenient both for taking the Dimensions, and also to work by: and as for the Scale of Scales, or thirtieth Scale that hath also already been placed on Jointed Rules; but then in the use thereof, you were forced to be at the charge and trouble of Dividers, which here you avoid. And also, there is another inconvenience, that when you had set your Scales to the desired Angle or Bevel, then you were forced to take it off with another Rule, because the Scales were one; yet the Rule varied: But here having

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ving set the Scale, the Rule is set also; so that you have no more to do, but to apply it to the place for which it was designed, and cut your Joint accordingly.

But I desire not to detain you here, but hasten to the businesse intended, and then, when you have consider'd of the manner, method, and commodiousnes thereof, I leave it to your Judgment, whether it be worth the Observation or no; the Author only desiring you to excuse the Brevity hereof; assuring you, that if you desire to be more fully instructed in any part hereof, he will be ready and willing truly and faithfully to answer your desire; for I must confess, that the narrownes of my present intentions would not permit of a full discovery, especially of these parts, namely, Surveying of Land, and Gauging: But if any one desire a more full Discovery thereof, as I said before, I will assuredly assist them to the best of my knowledge, either in the use of the Theodolite Semicircle, Quadrant, or Plain Table; and also for Gauging, I will faithfully instruct you in the best and truest method I know, wherein I dare be bold to affirm, that it is more true than some

Rules

To the Ingenious Reader.

Rules which have been deliver'd by other Authors.

The Author also desires you to take notice, that the said Rule here described, is truly and exactly made by none but himself, who maketh them, or any other Instruments at reasonable rates; and any Person that takes any quantity by Wholesale, he will allow them considerable profit in selling them. I also put the Sliding part on long Two-foot Rules without Joints, so that thereby the Scales are longer, and by consequence, the Operations the more exact; also my ordinary Rules, I make with a Brass Joint, so that thereby they are rendred the more safe from breaking: As also Diagonal Rules for Gaugers, or other Gaugers Instruments, where Joints are requisite, I make them with Brass Joints; so that by reason of their being wet, they are not damnified. So for the present, I rest and remain ready to serve you in the well-making these or any other Mathematical Instruments,

JOSEPH SELDEN.

At the *Sun-Dial* at *Tunbridge-Wells*, Octob. 12th. 1693.

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IF any Gentleman or other desire to have any Land surveyed or mapt; or Building, or Timber surveyed, or measured, the Author will perform it with the greatest care and exactness imaginable.

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AN INTRODUCTION TO Arithmetick.

WHosoever desireth to understand the Art of Measuring, or finding out the Contents of any thing, either Superficies or Solid, ought to understand Arithmetick: Therefore for their sakes which are ignorant of Arithmetick, I shall here treat of the Five Parts thereof; and in each I shall handle both Vulgar and Decimal; Vulgar for the

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ſake of the Unlearned, becauſe I would not be wanting in any thing that might be beneficial to the induſtrious and well-willer: but as for the carping Critick, I queſtion not, but I ſhall be offenſive, and perhaps make him ſwell with malice, till he is almoſt burſted; but let me deſire him to be pacified, and reſt himſelf contented; for I muſt needs tell him in plain terms, that his Envy I value not ſo much as a ſtraw; ſince what I have here written, I am no way beholding to him for; but enough of this, and too much now to the buſineſs in hand. I ſhall alſo treat of Decimary, becauſe that is the moſt approved, beſt, eaſieſt, and familiar for all Artificers and Surveyers to practiſe; and it is alſo more agreeable to the Inſtrument here preſcribed; but I muſt be very brief, leſt I exceed my intended Limits.

Firſt then of Numeration: Numeration is that part of Arithmetick which teacheth to number all Figures, and is of three kinds, that is to ſay, Digits, Articles, and Compound Numbers: Firſt, a Digit; of Digits are

are theſe Ten, *viz.* 1, 2, 3, 4, 5, 6, 7, 8, 9, 0. of Articles are theſe, *viz.* 10, 20, 30, 40, 50, *&c.* Of compound Numbers are theſe, *viz.* 10, 20, 30, 40, 50, *&c.* Alſo in numbering of Figures, there is to be obſerved their place and their value; their place is the place where they ſtand, their value is according to their place; as 2 ſtanding alone, is two; but if he had been placed with another with him, he had been twenty, thus 20. Where obſerve, that each place towards the left hand, betokeneth ten times its value it did before. But this following Table will better inform you.

Numeration Table.

Hundreds of millions.	Tens of millions.	Millions.	Hundreds of Thousands.	Tens of Thousands.	Thousands.	Hundreds.	Tens.	Ones, or Unites.	
								1	1
							2	1	21
						3	2	1	321
					4	3	2	1	4321
				5	4	3	2	1	54321
			6	5	4	3	2	1	654321
		7	6	5	4	3	2	1	7654321
	8	7	6	5	4	3	2	1	87654321
9	8	7	6	5	4	3	2	1	987654321

Here you see, that each place toward the left hand, is ten times more than those before; and must be numbered thus, saying, Unites, Tens, Hundreds, Thousands, &c. as in the head of the Table. then you must say as you see in the side of the Table, Thus,

So

So here by this Table you ſee, that every place towards the left hand is ten times ſo much as before; ſo theſe following Numbers muſt be read thus, 5, five, 50, fifty, 500, five hundred: Again, theſe Numbers muſt be read thus, 234, Two Hundred thirty four: 2345, Two Thouſand three hundred forty five; and ſo of others, which for brevity's ſake I muſt omit.

But whereas I told you, that Decimals were the moſt uſed, beſt and eaſieſt, therefore I promiſed to ſhew that way of working; therefore as I have ſaid ſomething to the Numeration of Vulgar Numbers, ſo I ſhall alſo treat briefly of the Numeration of Decimals, which take as followeth: Firſt then, I will tell you what a Decimal is, a Decimal is that by which the part or parts of an Unite are diſtinguiſhed, and is known by placing a point or prick on the left hand ſide, and its value is decreaſed from ſo many Unites to ſo many tenth parts of an Unite; and if a Point and a Cypher, or a Digit be prefixed, it will be ſo many hundred parts;

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parts;

parts; and if a Point and two Cyphers or Digits be prefixed, its value is decreaſed to be ſo many thouſand parts; as if you would prefix before the Figure 2 a Point, thus (.2) 'tis then decreaſed from 2 Unites to two tenth parts of an Unite; and if you prefix a Point and a Cypher thus (.02) it is decreaſed from 2 Unites to 2 hundredth parts of an Unite.

For as in whole Numbers, the value or denomination of places increaſes by tens from the Unites place, towards the left hand; ſo in Decimals, the value or denomination of places decreaſes by tens from the Unites place, towards the right hand, as in the following Example: In which I have ſet an Unite in its due place; and all the Figures towards the left hand, being whole Numbers, do increaſe by tens; for the Figure 2. next the Unite 1, is 2 tens, or 20. the next is 3 hundred, and the next is 4 thouſand, &c. See the Example.

Hundreds of thousands.	Tens of thousands.	Thousands.	Hundreds.	Tens.	Unite.	Tenth parts of an Unite.	Hundred parts of an Unite.	Thousand parts of an Unite.	Ten thousand parts of an Unite.	Hundred thousand parts of an Unite.
6	5	4	3	2	1	2	3	4	5	6

But all the Figures from the Unites place towards the right hand, being Decimals, do decreaſe by tens; ſo the Figure 2. towards the right hand, is 2 tenth parts, the next is three hundred parts, and the next 4 thouſand parts of one, or an Unite, each place being ten times leſs than in the next place before towards the left hand.

In Decimal Arithmetick we always imagine, and indeed it would be ve-

ry

ry commodious if it were really ſo, that all intire Unites, Integers, and things, were divided into ten equal parts; and each of theſe parts ſo divided we call Primes, we alſo divide each of theſe Primes into other ten equal parts, and every of theſe diviſions we call ſeconds, and each of theſe again into other ten equal parts, and thoſe are called 3ds. & ſo to 4th. 5th, 6th, &c. And ſo one Prime is $\frac{1}{10}$ or one tenth of an Unite, one ſecond is $\frac{1}{10}$ of $\frac{1}{10}$ or $\frac{1}{100}$ part of an Unite; and ſo by dividing the former and ſubdividing the latter, we may run on *ad infinitum*.

As ſuppoſe One Pound Sterling be given to be decimally divided; according to the Notion premiſed, the firſt diviſion muſt be Primes, the next diviſion ſeconds, the next thirds, &c. So One Pound Sterling being 20 Shillings, which divided into ten equal parts, one of theſe parts is one Prim, and is in value 2 Shillings, and will ſtand thus (.1) three Prims or three tenths of a pound, or 20 Shillings will ſtand thus (.3) and is in value 6 s. Again, one Prime or (.1) being

being divided into ten equal parts, each of these parts will be one second, or one hundredth part of 20 s. and is thus expressed (.01) and is in value .2 d. farthings, and six tenths of a farthing; and if (.01) be divided into ten equal parts, each of these parts will be thirds, or one thousand part of a pound, or 20 s. and will stand thus (.001) and its value will be 96 one hundred part of a farthing.

The like may be understood of One Pound Troy, or Averdupois weight, one Foot, one Inch, one Ell, Yard, Bushel, Gallon, or any thing else whatsoever.

A Decimal whether it stand alone, or joined with whole Numbers, is ever distinguished from a whole Number by a Point or Prick before it, towards the left hand: As in these Examples.

, ·4752 4·752 47·52 475·2

In Decimals the Numerators only are always set down, the Denominators being known by the number of places

ry commodious if it were really so, that all intire Unites, Integers, and things, were divided into ten equal parts; and each of these parts so divided we call Primes, we also divide each of these Primes into other ten equal parts, and every of these divisions we call seconds, and each of these again into other ten equal parts, and those are called 3ds. & so to 4th. 5th, 6th, &c. And so one Prime is $\frac{1}{10}$ or one teath of an Unite, one second is $\frac{1}{10}$ of $\frac{1}{10}$ or $\frac{1}{100}$ part of an Unite; and so by dividing the former and subdividing the latter, we may run on *ad infinitum*.

As suppose One Pound Sterling be given to be decimally divided; according to the Notion premised, the first divition must be Primes, the next divition seconds, the next thirds, &c. So One Pound Sterling being 20 Shillings, which divided into ten equal parts, one of these parts is one Prim, and is in value 2 Shillings, and will stand thus (.1) three Prims or three tenths of a pound, or 20 Shillings will stand thus (.3) and is in value 6 s. Again, one Prime or (.1) being

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places in the Numerator; for if the Numerator consist of but one place, the Denominator is 10. if of 2 places, the Denominator is 100. if of 3, then 1000. if of 4, then 10000.

Example.

The Denominator of { .2, .25, .051, .0572 } is { 10, 100, 1000, 10000 }

As Cyphers before a whole Number have no value, so Cyphers after Decimals are of no signification, and therefore will not increase their value, nor alter the Denominator; for .2 is two tenth parts, .20 is no more.

Also as Cyphers after whole Numbers, increase their value, so Cyphers before Decimals do diminish their value: As in these Examples.

{ .5, .05, .005, .0005 } is 5 { tenth, hundred, thousand, ten thousand } parts

So

So much at preſent ſhall ſuffice for Numeration: Now followeth Addition.

Addition both of Whole Numbers and Decimals.

ADdition is that part of Arithmetick which teacheth to add two or more Sums or Numbers together, wherein obſerve to ſet down your Sums directly one under another, and be ſure to place Unites under Unites, and Tens under Tens: As ſuppoſe I were to add 252 and 345 together, then I muſt place them one under another, and draw a line under them both.

Thus 252
345

597

Then begin with Unites, and ſay, 5 and 2 is 7, ſet down the 7 under the 5 and 2 in the Unites place; then ſay,

ſay, 4 and 5 is 9, place 9 under 4 and 5 in the ſecond or tens place; and laſtly ſay, 3 and 2 is 5, ſet 5 under 3 and 2 in the third or hundred place, then draw a line under that laſt Sum, and ſo you will find, that 252 and 345 will make 597, being added together.

Again, ſuppoſe 5493 and 2357 were to be added together, ſet them down as before, with a line under.

Thus 5493
2357

7850

Then ſay, 7 and 3 is 10, ſet down the 0 under the 7 and 3, and carry the 10 to the next place, and there he maketh one; then ſay, one that I bring and 5 is 6, and 9 is 15, then ſet down the 5, and carry the ten to the next place, as before; where he maketh one, as before; Then ſay, one that I bring and 3 is 4, and 4 is 8, ſet down the 8; then ſay 2 and 5 is 7, ſet down the 7, and draw

a

a line underneath, and you have done, and find that 5493 and 2357 makes 7850.

I shall leave you one Example ready cast up to your hand, and so proceed to the Addition of Mony.

345693
911748
1257441

Addition of Mony.

As before you observed to set Unites under Unites, and Tens under Tens, so here you must observe to set Pence under Pence, Shillings under Shillings, Pounds under Pounds, and ought to be set down in this order, with a dash between: Thus 15—11—05 Also note, that Pounds are marked over with *lb.*

lb.
Thus——15—00—00
s.
And shillings with *s.* thus 00—11—00
d.
And Pence with *d.* thus 00—00—05

Example.

say, 4 and 5 is 9, place 9 under 4 and 5 in the second or tens place; and lastly say, 3 and 2 is 5, set 5 under 3 and 2 in the third or hundred place, then draw a line under that last Sum, and so you will find, that 252 and 345 will make 597, being added together.

Again, suppose 5493 and 2357 were to be added together, set them down as before, with a line under.

Thus 5493
2357
7850

Then say, 7 and 3 is 10, set down the 0 under the 7 and 3, and carry the 10 to the next place, and there he maketh one; then say, one that I bring and 5 is 6, and 9 is 15, then set down the 5, and carry the ten to the next place, as before; where he maketh one, as before; Then say, one that I bring and 3 is 4, and 4 is 8, set down the 8; then say, 2 and 5 is 7, set down the 7, and draw

a

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d.

And Pence with *d.* thus 00—00—05

Example.

Example the first.

lb. s. d. *lb. s. d.*

Suppoſe 15—07—03 and 09-15-10 were to be added together, then ſet them down one under another, and draw a line.

	lb.	*s.*	*d.*
Thus	15	07	03
	09	15	10

Now here note, that 12 pence makes a Shilling, 20 Shillings make a pound.

Then begin with the pence, and ſay, 10 pence and 3 pence, is 13 pence; now 12 pence being a ſhilling, 13 pence is 1 ſhilling and a penny, therefore you muſt ſet down the 1 penny under

lb.	*s.*	*d.*
15	07	03
09	15	10
Total Sum is 25	03	01

the

the pence, and carry the ſhilling to the place of ſhillings, and ſay, one ſhilling that I brought, and 5 ſhillings is 6 ſhillings, then 6 ſhillings and 7 ſhillings is 13 ſhillings; The 3 ſhillings I ſet down under the place of ſhillings, and the ten ſhillings carry to the next place, and ſay, 10 that I bring and 10 is 20 ſhillings; now twenty ſhillings making a pound, I write 0 in its place, and carry 1 pound to the place of pounds, and ſay, 1 that I bring and 9 is 10, then 10 and 5 is 15, the 5 I ſet down, and carry 1 to the next place, and ſay, 1 that I bring, and 1 is 2, which I ſet down alſo, and then draw a line under all, and ſo finiſh the Sum, whereby I find, that 15 — 07 — 03 and 09 — 15 — 10 added together, makes 25 — 03 — 01.

For brevity's ſake, I ſhall only ſhew one Example more ready caſt up, by which you may prove your Skill.

Thus

	lb.	s.	d.
Thus	1234	—18	—11
	5342	—17	—10
	7934	—10	—02
Total sum is	14512	—06	—11

Addition of Decimals.

Suppose 25 and 3 tenth parts, and 15 and 7 teath parts were to be added together, you must set them down as if they were all whole Numbers; for there is no difference between Addition of whole Numbers and the adding of Decimals, only note to put a prick between the whole Number and the Decimal, for distinctions sake; then work in all respects as if all were whole Numbers.

Thus	25.3	Again thus	543.24
	15.7		459.32
The sum	41.0	The Sum	1002.56

Sub-

Subſtraction of Whole Numbers and Decimals.

Subſtraction is that part of Arithmetick which teacheth to ſubſtract a ſmall Sum out of a great one: As ſuppoſe 234 were to be ſubſtracted out of 435, then ſet them down orderly; the great Sum firſt, then the leaſt next under the other, as was taught in Addition.

Thus	435
	234
Remains	201

Then ſay, 4 from 5, and there remains 1, which 1 ſet down under the line; then ſay 3 from 3, and there remains 0. which alſo ſet down in its due place; then ſay, 2 from 4, and there remains 2, which 2 ſet down; and then draw a line under all, and finiſh the Work, ſo that you ſee 234 taken or ſubſtracted from 435, there will remain 201.

Example the ſecond.

Thus 523421
234567

Remains 288854

Here, as before, begin with the Unites, and ſay, 7 from 1 I cannot, but 7 from 11, borrowing one from the next place, and there remains 4. which ſet down; then ſay, 1 that I borrowed (for be ſure in Learning do not forget to be honeſt, but remember to pay what you borrow) and 6 makes 7; then 7 from 2 I cannot, but 7 from 12, and there remains 5, which ſet down; again, 5 and 1 that I borrowed makes 6, then 6 from 4 I cannot, but 6 from 14 and there remains 8, which 8 ſet down; then ſay, 4 and 1 that I borrowed is 5, then 5 from 3 I cannot, but 5 from 13 and there remains 8, which ſet down; again, ſay, 3 and 1 that I borrowed is 4, then 4 from 2 I cannot, but 4 from 12 and there remains 8, which

which 8 ſet down; then laſtly, ſay, 1 that I borrowed and 2 is 3, then 3 from 5 and there remains 2, which 2 ſet down, and with a line under them finiſh your work.

Example the third, ready caſt up.

Thus	23437911
	05711023
Remains	17726888

Subſtraction of Mony.

As in Addition, ſo here muſt be noted how many of one Denomination makes one of the next, and your Sums muſt be ſet one under another.

	lb.	*s.*	*d.*
Thus	12	11	10
	02	10	05
Remains	10	01	05

Here begin with the pence, ſaying, 5 pence from 10 pence, and there remains 5 pence, which ſet down under the pence; then ſay, 10 ſhillings from 11 ſhillings, and there remains 1 ſhilling, which ſet down under the ſhillings; then again, ſay, 2 pounds from 12 pounds, and there remains 10 pounds, which 10 pounds ſet down under the pounds; and draw a line underneath, and finiſh; whereby you will ſee, that 02—10—05 taken out of 12—11—10 there remains 10—01—05.

One Example left to premiſe.

	lb.	*s.*	*d.*
Thus	1234	18	10
	0549	19	11
Remains	684	18	11

Subſtraction

Subſtraction of Decimals.

As in Addition there was no difference between the working of whole Numbers and Decimals, only the Decimal to be noted by a point. So in Subſtraction the ſame method is to be uſed as in whole Numbers.

Thus	23.25
	12.34
Remains	10.91

Here you ſee 12 and .34 parts ſubſtracted from 23 and .25 parts, there will remain 10 and 91 parts.

Or thus	923.445
	212.543
Remains	710.902

Here 212 and .543 parts being ſubſtracted from 923 and .445 parts, there remains 710 and .902 parts.

Again thus 453.20
123.59

Remains 329.61

Of Multiplication both Vulgar, Decimal, and Inſtrumental.

FIrſt then, Multiplication is that part of Arithmetick which teacheth to multiply two Sums together; whereof cometh a third Number, which is called the Product; where note, that there is the Multiplicand and the Multiplicator, and the Product.

Now then ſuppoſe, that 23 were to be multiplyed by 7, and to find their Product; then ſet them down thus: where Note, that it is moſt proper (tho' it matters not much) to ſet down the greateſt Sum uppermoſt, and draw a line under them both.

Thus

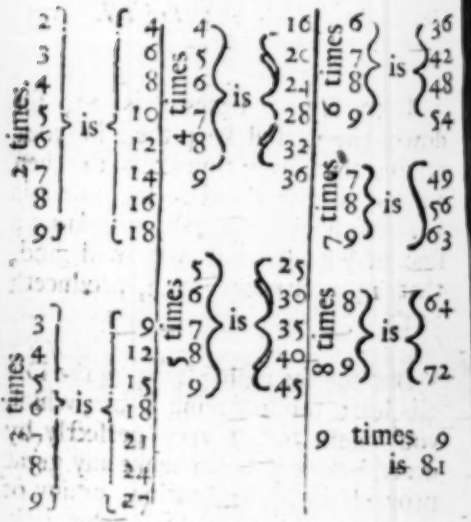
Thus 23 *Multiplicand.*
7 *Multiplicator.*

161 *Product.*

Then ſay, 7 times 3 is 21, ſet down the 1, and keep the 2 in your mind; then ſay, 7 times 2 is 14, then 14 and 2 that I had in my mind is 16, which 16 ſet down, and draw a line under all, and you will find, that 23 multiplied by 7, produceth 161.

But for the multiplying of the Digits, learn this following Table, which you ought to get very perfectly by heart, before you can make any great progreſs in Multiplication, or any of the following Rules of Arithmetick.

The Multiplication Table.



By this Table you may learn to multiply all the Digits: Thus, first you have the figure 2 with the word *times* annexed; then you have 2, 3, 4, 5, 6, 7, 8, 9, all one under another; then you have the word *is* on the right hand side, then you have

have 4, 6, 8, 10, 12, 14, 16, 18, and ſheweth, that 2 times 2 is 4, and 2 times 3 is 6, and 2 times 4 is 8, and 2 times 5 is 10, and ſo of the reſt, till you have the Multiplication of all the 9 Digits; wherein the laſt you find, 9 times 9 is 81. Obſerve the Table, and by a little practice, you will find it out; for one hours practice will learn you more than half a days reading; and in caſe thou ſhouldſt try, and miſs the Mark, I adviſe thee not to be diſcouraged, but try again: for through thy many Trials and Induſtry, 'tis very probable thou mayſt hit the Mark, and obtain thy deſired ends: For it is through Study, Care, and Induſtry, that it hath pleaſed the Almighty God, and moſt wiſe Creator to reveal the moſt occult Myſteries, and profound Learning, to the moſt curious ſearchers; for which, if thou doſt obtain the leaſt knowledge, be ſure not forget from whence all knowledge comes, but implore his Aſſiſtance, and render to him all praiſe and thanks for what thou haſt attained.

Now then, if thou haſt perfectly gotten the former Multiplication Table by heart, then proceed as followeth: Suppoſe to multiply 2345 by 23.

Place them thus 2345 *Multiplicand.*
23 *Multiplicator.*

7035
4690

53935 *Product.*

Then begin with the right hand Figure of the Multiplicator, *viz.* 3, and ſay, 3 times 5 is 15, ſet down the 5, and keep the 1 in your mind; then ſay, 3 times 4 is 12, and the 1 in my mind is 13, ſet down the 3, and keep the 1 in mind; then ſay, 3 times 3 is 9, and 1 in my mind is 10, ſet down the 0, and keep the 1 in mind; then ſay, 3 times 2 is 6, and 1 in my mind is 7, which 7 ſet down: then begin with the 2 in in the Multiplicator, and do with him as you did with the 3; ſaying,

saying, 2 times 5 is 10, set down the 0, and keep the 1 in mind; but here note, to set the 0 under the other Sum last set down; and also note, to place him towards the left hand under the place of tens; then proceed, and say, 2 times 4 is 8, and 1 in my mind is 9, which set down; then 2 times 3 is 6, which set down; lastly, say 2 times 2 is 4, which 4 also set down, and draw a line under all; and then add these two Sums together, saying, 5 is 5, which set down under the line, then 0 and 3 is 3, which 3 set down; then 9 and 0 is 9, which 9 set down; then say, 6 and 7 is 13, set down the 3, and carry the 1 to the next place, saying, 1 that I bring and 4 is 5, which set down, and draw a line under all, and finish the work; whereby you will find that 2345 multiplied by 23, produceth 53935.

Note, that so many Figures as you have in your Multiplicator, so many Rows will be in the Product before they are added together.

Also

Alſo note, That each Figure in the Multiplicator, that ſo many places as he is from the right hand, ſo many places muſt the firſt figure of his Row be placed toward the left hand: As you may ſee if you obſerve the following Sum.

Example.

```
  23456
   3523
 -------
  70368
 46912
117280
70368
-------
82635488
-------
```

Note, that in adding of the Products, you obſerve to keep Unites under Unites, Tens under Tens, as in the Example.

Note alſo, that to multiply by 10, 100 or 1000, it is but to add the Cypher to the Multiplicand, and your work is done: Thus, 5 multiplied

tiplied by 10, makes 50, and by 100 makes 500. &c.

Multiplication of Decimals.

In multiplying of Decimals, there is no difference from that of multiplying of Whole Numbers; only note, that ſo many Decimal Figures as you have in both Multiplicand and Multiplicator, ſo many Decimal Figures there will be in the Product: As in this Example, ſuppoſe I were to multiply 23.75 parts by 7, then ſet them down, and multiply the 23.75 by the 7.

Thus 23.75
7
166.25

Here

Here you ſee that 23.75 multiplied by 7, the Product is 166.25 parts, becauſe I had two Figures that were Decimals in the Multiplicand, and none in the Multiplicator, therefore I only prick off the 25 for Decimals in the Product. But if both Multiplicand and Multiplicator had Decimals, then I muſt have prick'd off ſo many from the Product: As ſuppoſe that 23.75 parts were to be multiplied by 7.5 parts, then I muſt have ſet them down, and worked

Thus

```
  23.75
   7.5
 -------
  11875
 16625
 -------
 178.125
 -------
```

Here I prick off the three figures from the Product, becauſe I had two in the Multiplicand, *viz.* .75, and 1 in the Multiplicator, *viz.* .5, ſo that both makes 3, therefore I muſt prick off three figures from the Product,

as

as you ſee in the Example I have pricked off .125.

I ſhall give you one Example more that will have four Decimal Figures in the Product, *viz.* two in the Multiplicand, and two in the Multiplicator.

```
Thus      23.75
           7.53
        ---------
           7125
         11875
        16625
        ---------
        178.8375
        ---------
```

So here I prick off four, *viz.* 8375 for Decimal Parts; but ſometimes it happeneth in multiplying of Decimals, that there are not ſo many figures in the Product as there are Decimals in the two Numbers to be multiplied. You are then to place Cyphers on the left hand ſide of the Product, till the number of places be equal.

As

As in theſe Examples.

.04	.75	8.5
.6	.05	.005
024	0375	.0425

Note, that as Whole Numbers being multiplied by Whole Numbers increaſe their value, ſo Decimals multiplied by Decimals do decreaſe their value, becauſe the Product is removed farther from Unity than either of the Decimals given to be multiplied, as appears by the laſt Examples.

As in whole Numbers ſo in Decimals, that are to be multiplied by Tens, Hundreds, or Thouſands, you need only remove the prick ſo many places towards the right hand, as there are Cyphers in the Multiplicand.

As ſuppoſe you were to multiply .7562 by 10, 100, 1000, your work will ſtand

Thus

Thus.			
7562 multiplyed by	10	the product will be	7.562
	100		75.62
	1000		756.2

I shall now come to the use of the Sliding Rule, which said Rule is most commodious and very exact in working most Questions in Arithmetick; for indeed it was only upon the account of the said Rule, that I have written both the Preventional and Postventional Lines, because that the Rule without Arithmetick might seem the more obscure; so Arithmetick without the Rule, will be nothing near so convenient: and for that reason, I have here spoken of both; and though Arithmetick is taught very plain, and more largely in several other Authors, yet perhaps this Book may come into some hands that are ignorant of Arithmetick: Therefore for their sakes I have written this Introduction, and though the lines on the Rule by which the said Arithmetical Questions are resolved,

are

are well-known to moſt Artificers, being the Line of Proportion, commonly called Gunters Line, and is here twice repeated, and lyeth edge to edge; one of them being placed on the out-ſide of the Rule, and is marked at the head with (*a*) the other is placed on the Sliding-Piece, and join'd to the other, and is marked with (*b*). I ſay, by theſe two lines may moſt Arithmetical Queſtions be reſolved; and firſt I will ſhew the working of Multiplication by the ſaid lines; but yet perhaps the ſaid Rule and Lines may fall into the hands of ſome which do not yet know what the Line of Proportion or Gunters Line is; therefore for their ſakes, I ſhall endeavour to explain it as followeth.

The Line is a Geometrical Proportion, divided firſt into nine unequal parts, called Primes, which are diſtinguiſhed by Figures, thus, 1, 2, 3, 4, 5, 6, 7, 8, 9. and then each of theſe Primes are ſubdivided into ten other parts, according to the ſame Reaſon, called tenths; and again, each of theſe tenths ſubdivided, or at leaſt

ſuppoſed

ſuppoſed ſo to be divided into ten other parts, according as the length of the lines will permit, otherwiſe the ſaid Primes are only divided into five parts; or if they will not admit of that Diviſion, they are only divided into two parts; and if they will not admit of this Diviſion neither, then the Primes are only divided into ten parts, as ſome of theſe on the Rule are.

Note that the Figures 1,2,3,4,5,6,7,8,9, &c. by which the Primes are diſtinguiſhed, are all Arbitrary Points, and may each of them repreſent ſo many intire Unites, Tens, Hundreds, or Thouſands, or they may alſo repreſent ſo many Tenth, Hundredth or Thouſandth parts of an Unite: firſt for whole or intire Unites, let the firſt Prime or Figure 1. at the beginning or left hand end, repreſent one Unite, then ſhall all the Figures towards the right hand, *viz.* 2. 3. 4. 5. 6. 7. 8. 9. 10. repreſent ſo many Unites; and the tenths in each Prime will be tenth parts of an Unite; and where theſe parts are divided, or ſuppoſed to be divided, each Diviſion is one hund-

hundredth part of an Unite: or, again, let 1 at the beginning of the line repreſent 10 Unites, then will each Prime forward repreſent 10 times ſo many Unites as the Figures expreſs: Thus the Figures 2. 3. 4. 5. 6. &c. will be 20. 30. 40. 50. 60. &c. Alſo when one Prime repreſents 10 Unites, each tenth in that Prime will be 1 Unite. Again, let the firſt Prime repreſent 100. then the Figures 2. 3. 4. 5. &c. will repreſent 200. 300. 400. 500. &c. And therefore 10 at the end of the Rule, will be 1000. and according to this ſuppoſition one tenth in each Prime 10 Unites, &c.

Thus far for counting of Whole Numbers on the Rule: Now to count Decimals.

For Decimals, let 10 in the middle of the line repreſent one, then each Prime towards the left hand will be .1, or one tenth .2, or two tenths .3, .4, &c. And in thoſe Primes each tenth will be .01, .02, .03, or four hundredth part of an Unite.

To make this more plain, draw out the Sliding-piece (*b*) till 1 at the beginning

beginning of the line be exactly against 10 in the end of the line (*a*) for then you have a line of Proportion four times repeated, upon which let 1 at the beginning of the line (*a*) represent .1 Unite; then shall .1 in the middle of the line (*a*) represent .10, and .10 in the end of the line (*a*) or beginning of the line (*b*) to represent .100 and in the middle of the line (*b*) will be .1000. and in the end of the line (*b*) will be 10000.

But keeping the Rule as it now stands; let 10 at the right hand end of the line (*b*) represent 1, then shall each Prime in the fourth Radius; for observe, that each part from 1 to 10, is called Radius; so that on both lines, are 4 Radiuses; so that I say then, each Prime in the fourth Radius representeth .1 in the .01 in the second .001 and in the first .0001 part of an Unite.

So will 2 in the first be .0002 in the second .002, in the third .02, and in the fourth .2 parts of an Unite.

These preceding Rules being well premised, you will be enabled to find out

out the point that ſhall repreſent any number given.

As for Example, ſuppoſe the number 126. were required to be known, then the firſt figure thereof, *viz.* 1. I count 1 at the beginning of the lines, either (*a*) or (*b*), for both are alike; for the ſecond Figure, *viz.* 2. I count 2 Primes; and for the 6 I count three of the ſmall Diviſions, for each of them will repreſent 2, when the firſt 1 doth repreſent 100, as in this ſuppoſition; but Practice will better inform you in this caſe, than reading.

Alſo note, that Decimals and mixt Numbers are diſcovered in the ſame manner as whole Numbers; for if the whole Number were 12, and the Decimal were .6, as in the former Number, the ſame point would repreſent it as before.

If what hath been ſaid, be well premiſed, I doubt not but by a little practice, an ordinary Genious will be inabled to diſtinguiſh on the Rule any Number propoſed. Having thus far deſcribed the lines, I will now proceed to the uſe of them.

And

And first of Multiplication.

Of Multiplication by the Rule.

In Multiplication either of whole Numbers mixt, or Decimals, the Proportion is

As 1 is to the Multiplicator, so is the Multiplicand to the Product, and the Product of any two Numbers shall have so many places as there be in both the Numbers given; except when the lesser of them do not exceed so many of the first Figures of the Product, then it will have one less.

Example.

Suppose that .6. were to be multiplied by .4. then say, as .1. is to .4. so is .6. to .24. therefore set 1 on the line *(b)* exactly against 4 on the line *(a)* then will 6 on the line *(b)* stand against 24 on the line *(a)* which is the Product sought; but it matters not whether you take the Number 1 on the line *(b)* or *(a)*, neither

ther is it any matter which of the two Numbers that are to be multiplied, you ſet the number 1 to; for if you had ſet 1 on either of the Lines to 6 on the other Line, then againſt 4 on that line which you counted the 1 on, would be 24 on that Line you counted 6 on; only note, that the firſt and third term be counted on one and the ſame Line, and the ſecond and fourth on the other.

Example the ſecond.

Suppoſe 68. were to be multiplied by 26. the proportion is as 1 is to 26. ſo is 68 to 1728. By the Rule, ſet 1 on *(b)* even with 26 on *(a)*, then againſt 68 on *(b)* will be 1728 on *(a)*; but here note, that for the exact finding of great Numbers, where the Diviſion of the lines will not admit to explain, you may count 1 or 2 of the laſt in your mind, and then the other may be the better diſtinguiſhed on the lines: As here for the 8 in this laſt Product, I may ſay in my mind, 6 times 8 is 48; ſo that I find the laſt figure will be

8,

8, and then the other three, *viz.* 172 will be the better distinguished on the lines.

Example the third.

Suppose 68 were to be multiplied by 14, set 1 on *(b)* to 14 on *(a)*, then will 68 on *(b)* stand just against 952 on *(a)*; and here the Product is of fewer Figures by one than there were in the two Numbers given, because the lesser of them, *viz.* 14. doth not exceed so many of the first Figures of the Product.

I might here add more Examples, but these already given may serve for my present design, and so I come to Division.

Of Division.

IN Division there are two Numbers given to find a third unknown.

Note, that one of the Numbers are called Divisor, the other Dividend,

dend, and the Number ſought is called Quotient, and this Quotient doth ever contain Unity, ſo many times as the Diviſor is contained in the Dividend.

Alſo note, that the Diviſor muſt be always leſs than the Dividend, I mean in dividing of whole Numbers, but in Decimals it is not ſo.

Example.

Suppoſe 726 were to be divided by 6, then you muſt ſet them down with the 6 under 7 on the left hand ſide of the Numbers:

Thus 726(
6

then draw a crooked line on the right hand ſide of the Number, as you ſee in the Example.

Then begin your work, and ſay how many times 6 can I have in 7, which is 1, which 1 muſt be placed behind the Crooked line.

1
Thus 7 2 6 (1
6

Then

Then say, by Multiplication, once 6 is 6; then by Subſtraction ſay, 6 from 7, and there remains 1, which 1 muſt be ſet over the 7, and the 7, and 6 under the 7, muſt be cancell'd or ſcratched out with a daſh of the Pen, as you ſee in the Example.

So having done with one Figure of the Dividend, I muſt move the Diviſor one place nearer to the right hand.

Thus

	1	0		
	7	1	6	(12
	6	6		

Then ſay, how many times 6 can 1 have in 12, becauſe the 1 over the 7 that laſt remained, and the 2 over the 6 maketh 12; ſo I ſay, how many times 6 can I have in 12, which is two times, therefore I ſet 2 behind 1 in the Crooked line, and ſay, 2 times 6 is 12, then 12 from 12 and there remains 0, which 0 I ſet over the 2, and cancel the 12 and 6, as you ſee in the Example; then remove the 6 yet one place more towards the right hand, and ſet him under 6, and your work will ſtand

Thus 7 2 6 (12
6 6 6

Then ſay, how many times 6 can I have in 6, which is 1, therefore I ſet 1 behind the 2 in the Crooked line, and ſay, once 6 is 6, then 6 from 6 and there remains 0; and becauſe I have brought my Diviſor to the laſt place, I need not ſet it down, becauſe my work is finiſhed, and will ſtand

Thus 7 2 6 (121
6 6 6

And my Quotient is 121, which ſheweth, that 6 is contained in 726 121 times, the Proof of which is to multiply the Quotient by the Diviſor, and if the Product be equal with the Dividend, then is the Work true, otherwiſe not; for Multiplication is a Proof for Diviſion, and Diviſion a Proof for Multiplication: But to prove my laſt Diviſion, I place the Quotient and Diviſor, and multiply

Thus

Thus 121
6
726

So here I find the Product to be 726, as was the Dividend; therefore I conclude the work to be true.

Example the ſecond.

Suppoſe 550 were to be divided by 22, then place them as before,

Thus

Dividend	550	(*Quotient.*
Diviſor	22	

Then ſay, how many times 22 can I have in 55 ſtanding over, which is 2 times, therefore I place 2 in the Quotient.

Thus 11
550 (2
22

And say, 2 times 2 is 4, then 4 from 5 and there remains 1, which 1 set over the 5; then say again, 2 times 2 is 4, then 4 from 5 and there remains 1, which 1 set over the 5, and cancel both the 5's, and both the 2's, and place the 2's 1 place more towards the right hand.

Thus
11
550 (25
222
2

Then say, how many times 22 can I have in 110, or rather how many times 2 can I have in 11, which is 5 times; therefore I set 5 in the Quotient, and say, 5 times 2 is 10, then 10 from 0 I cannot, but 10 from 10 and there remains 0, which 0 set over the 0, and cancel the 0 and 2; then say, 5 times 2 is 10 and one that I borrowed is 11, then 11 from 11 and there remains 0; and so because I am come to the last place of the Dividend, I have done, and find the Quotient to be 25, and nothing remaining that tells

me

me that 550 doth contain 22, juſt 25 times.

But ſometimes, yea often it happeneth, that when the laſt Figure of the Diviſor is brought to the laſt Figure of the Dividend, yet there doth ſomething remain, which Remainders are called Fractions, Decimals or broken Numbers: As in this following

Example the third.

Suppoſe 13135 were to be divided by 25, then ſet them down as before, with the 25 under the two firſt left hand Figures, and alſo with the Crooked line.

Thus 13135 (
25

But here note, that becauſe 13 is leſs than 25, therefore before I begin to work, I muſt place 25 one place nearer the right hand.

06
Thus 13135 (5
25

Then ſay, how many times 25 can I have in 131, or rather, and which is more eaſier, ſay how many times 2 can I have in 13, and I can have 2 6 times in 13; but then there will be left but 11, and I cannot have 5 6 times out of 11, and I muſt not take 1 Figure more times than I can have all the reſt; ſo finding 6 to be ſo much, I try in my mind if I can have all the Figures 5 times, and I find I can; then I ſet 5 in the Quotient, and ſay, 5 times 5 is 25, then 25 from 1 I cannot, but 25 from 31, borrowing 3 from the next left hand place, and there remains 6, which 6 ſet over the 1; then ſay, 5 times 2 is 10, and 3 that I borrowed is 13, then 13 from 13, and there remains 0, which 0 ſet over the 3, and cancel the 131 in the Dividend, and the 25 in the Diviſor, and remove the Diviſor one place nearer your right hand.

1
~~4~~6 3
Thus 1~~3~~1~~3~~5 (52
~~2~~5 5
~~2~~

Then

Then ſay, how many times 25 can I have in 63 ſtanding over, which I find to be 2; I ſet 2 in the Quotient, and ſay, 2 times 5 is 10, then 10 from 3 I cannot, but 10 from 13 and there remains 3, which 3 ſet over the 3 in the Dividend, then ſay, 2 times 2 is 4, and 1 that I borrowed is 5, then 5 from 6 and there remains 1; which 1 ſet over the 6, as you ſee in the Example, and cancel the 6 and 3 in the Dividend, and the 25 in the Diviſor, and remove one place more towards the right hand.

Thus

11
0630
13185 (525
2555
22

Then ſay, how many times 25 can I have in 135, or how many times 2 can I have in 13; I try in my mind, and find I can have all but 5 times, therefore I ſet 5 in the Quotient, and ſay, 5 times 5 is 25, then 25 from 5 I cannot, but 25 from 25 and there remains 0, which 0 ſet over;

ver; then say, 5 times 2 is 10, and 2 as I borrowed is 12, then 12 from 13 and there remains 1, which 1 set over the 3, and cancel as before; and now I am come to the last place, and by my Quotient I find, that 13135 doth contain 25,525 times, and 10 remains, which 10 is $\frac{10}{25}$, or 10 25 parts of an Unite: But to find its value in Decimals, proceed by adding a Cypher or two to the Dividend, and then work as before, only put a prick in the Quotient to distinguish them from the whole Numbers, as hath been said before; the Cypher being added, remove

11
2650
Thus 13135 (525.4
25755
222

Then say, how many times 25 can I have in 100, I try and find it to be 4 times; therefore I set 4 in the Quotient behind the prick, and say 4 times 5 is 20, then 20 from 0 I cannot, but 20 from 20, borrowing 2, and there remains 0, which 0 set

ſet over, as before; then ſay, 4 times 2 is 8, and 2 that I borrowed is 10, then 10 from 10, and there remains 0. So that becauſe nothing remains, my work is done, otherwiſe I muſt have added more Cyphers, and continued my Diviſion till nothing had remained, or at leaſt till I had got 2 or 3 Decimal Figures.

I will ſhew one Example more that hath Decimal parts in both Dividend and Diviſor: As ſuppoſe 73.5 parts were to be divided by 2.5 parts, there is no difference between this and if they were all whole Numbers; the Operation being one and the ſame. Only note, that when the laſt Figure of the whole Number in the Diviſor is brought to the laſt Number of the Dividend, then what Quotional Figures you make more are Decimals: As in this Example.

Thus

23
73.5 (2
2.5

Here I ſay, how many times 25, as if all were whole Numbers, can I have

have in 73, which is 2, then ſetting 2 in the Quotient, and working as before, my work will be as you ſee above.

Then removing one place, and working as if all were whole Numbers, my work will ſtand

Thus

1
280
785 (29
255
2

And here you ſee, that the laſt whole Number of my Diviſor, *viz.* 2. is come to the laſt whole Number of the Dividend, *viz.* 3. and I have 10 remaining: Therefore I muſt put ſome Cyphers on the right hand ſide of the Dividend, and proceed again, as if it were whole Numbers, only put a prick in the Quotient, to diſtinguiſh it from the whole Numbers; for what Quotient you get now will be Decimals. The work will ſtand

Thus

```
        10
        2300
Thus    7350 (29.4
        2555
         22
```

So here I have 4 in the Quotient, and working as before, I have nothing remaining; so that 2.5 is contained in 73.5 29.4 times.

For the Proof of which, multiply the Quotient, *viz.* 29.4 by the Divisor, *viz.* 2.5, and if the Product be equal with the Dividend, then is the work true, otherwise not; work still as if all were whole Numbers, only note how many Decimal Figures you have in both Multiplicand and Multiplicator.

```
Thus    29.4
         2.5
       -----
        1470
       588
       -----
       73.50
       -----
```

So

have in 73, which is 2, then ſetting 2 in the Quotient, and working as before, my work will be as you ſee above.

Then removing one place, and working as if all were whole Numbers, my work will ſtand

Thus

1
230
785 (29
255
2

And here you ſee, that the laſt whole Number of my Diviſor, *viz.* 2. is come to the laſt whole Number of the Dividend, *viz.* 3. and I have 10 remaining: Therefore I muſt put ſome Cyphers on the right hand ſide of the Dividend, and proceed again, as if it were whole Numbers, only put a prick in the Quotient, to diſtinguiſh it from the whole Numbers; for what Quotient you get now will be Decimals. The work will ſtand

Thus

10
2500
Thus 7350 (29.4
2555
22

So here I have 4 in the Quotient, and working as before, I have nothing remaining; so that 2.5 is contained in 73.5 29.4 times.

For the Proof of which, multiply the Quotient, *viz.* 29.4 by the Divisor, *viz.* 2.5, and if the Product be equal with the Dividend, then is the work true, otherwise not; work still as if all were whole Numbers, only note how many Decimal Figures you have in both Multiplicand and Multiplicator.

Thus 29.4
2.5

1470
588

73.50

So

So here I find, that my Product is 73.50, equal with my Dividend, therefore I conclude that my work is true.

But here I have a 0, and in my Dividend I had none; but here you may remember, I added the 0 to find the Decimal, and continued my work till I had nothing remaining; and you may alſo remember that I told you before, that Cyphers on the right hand ſide of Decimals were of no ſignification, and ought to be ſtruck off; ſo that if you put out the 0, then will the Product be 73.5. as in the beginning.

But ſometimes it happeneth ſo, that if you add many Cyphers, and continue your Diviſion long, yet you will have ſome remainders; in this caſe continue your work, till you make your Decimal Quotient to conſiſt of 3 or 4 places, and it will be very near the truth; 2 or 3 may be ſufficient in moſt caſes.

Note, when any Number, either Decimal or mixt, is to be divided by 10, 100 or 1000, &c. only prick off ſo many places from the right hand

hand ſide of the Dividend, as you had Cyphers in the Diviſor, and your work is done. And thoſe that are prick'd off are Decimals, as ſuppoſe this Number, *viz.* 2345 were to be divided by 10.100, and a 1000, the work would be thus:

	The Quotient.	The Decimal part.
By	10	234.5
By	100	23.45
By	1000	2.345

But becauſe Multiplication is eaſier than Diviſion, and ſome may attain Multiplication and not Diviſion, therefore I will ſhew that what is performed by a Diviſor, may be performed by a Multiplicator; and how ſuch a Multiplicator may be found; ſuppoſe I were to divide 900 by 25, the Quotient will be 36.

Now let it be required to multiply 900 by a certain Number, that ſhall Produce 36. to find this Multiplicator, divide a Unite with Cyphers by 25 the Diviſor propoſed, the Quotient will be .04 the Multiplicator ſought; for 900 multiplied by .04, the Product will be 36

which

which was required; or if you have a Multiplicator to find a Diviſor, this is but the reverſe of the former; for if a Unite with Cyphers be divided by .04 a Multiplicator, the Quotient will be 25, the Diviſor as before.

Now followeth to find the value of a Decimal, or to reduct a Decimal into its known parts of the integer: work thus, if the Decimal be parts of a pound ſterling, multiply it by 20, the ſhillings in a pound; then prick off ſo many places from the right hand, as you had places in your Decimal, and what remains towards the left hand will be ſhillings; then multiply the parts prickt off by 12, the pence in a ſhilling, and from the Product prick off the number of places, as was in the Decimal, as before; what remains towards the left hand is pence: then the parts towards the right hand, multiply by 4, the farthings in a penny; prick off as before, and thoſe Figures on the left hand of the prick are farthings, and thoſe on the right hand are parts of a farthing.

Example.

Example.

Suppose .235 were the Decimal of a pound Sterling,

Work thus .235
20

Shillings 5.700 parts of a ſhill.
12

1400
700

Pence 8.400 pts. of a penny.
4

Farthings 1.600 pts. of a *farthing*

So here you ſee that .235 parts of a pound is 5 ſhillings 8 pence 1 farthing, and .600 or 6 tenth parts of a farthing.

So the value of .60625 will be found to be 12 *ſhill.* 1 *penny*, 2 *farth.*

Thus

Thus .60625
20

12 Shill. 12.12500 parts of a Shilling.
12

.25000
.12500

1 Penny 1.50000 parts of a Penny.
4

2 Farth. 2.00000 no parts.

Or ſuppoſe .234 were the Decimal of a foot, then becauſe 12 inches is a foot,

Work thus 234 parts of a foot.
12

468
234

2 Inches 2.808 parts of an Inch.

And becauſe 4 Quarters make one Inch, work

Thus

Thus 808 parts of an Inch.
4

3 quart. of inch 3.232 parts of a quarter of an inch.

But ſuppoſe you had any Number of Inches, and deſired to know what Decimal ſignified that Number of Inches; or if you had Shillings, and deſired a Decimal for them, this is but the reverſe of the former: As ſuppoſe the laſt Example of Mony, *viz.* 12 *s.*—01 *d.*—2 *farth.* as before I multiplied, ſo now I divide by the ſame I multiplied by before, beginning with the farthing, and ſo adding Cyphers till nothing remain.

Thus farthings 2, add a Cypher, and divide by 4, the farthings in a penny.

2 0 (.5
4

Here the Decimal is .5, now for the penny, add him to this .5; but on the left hand ſide, becauſe he is the bigger Denomination; then divide by

12,

12, the pence in a ſhilling, adding Cyphers if need be, on the right hand:

```
        36
Thus   1500 (.125
       1222
        11
```

Here the Decimal is .125, then to this ſet down the 12 Shillings on the left hand, and divide by 20, adding Cyphers if need be.

```
        0  05
Thus   12.12500 (.60625
       200000
        2222
```

So here you ſee, that I have .60625, and nothing remaining, which is the Decimal of 12 *s.*—01 *d.* – 02 *farth.* as before. Theſe things being well premiſed, I hope by a little practice you will be inabled to work Decimals: And ſo I ſhall paſs on to ſhew Diviſion by the Rule.

Of

Of Diviſion by the Rule.

IN Diviſion both of whole Numbers and mixt, the Proportion is, as the Diviſor is to 1, ſo is the Dividend to the Quotient.

Note, that the Quotient hath always ſo many Figures as the Dividend hath more than the Diviſor, except when the Diviſor doth not exceed ſo many of the firſt Figures of the Dividend, then it hath one place more.

Example.

Suppoſe it were required to divide 58 by 29, the proportion is as 29 to 58, ſo is 1 to 2. Thus ſet the Diviſor, *viz.* 29 even with 58, then againſt 1 is 2. Again, ſuppoſe 48 were to be divided by 8, then ſet 8 on *(b)* againſt 48 on *(a)*, then againſt 1 on *(b)* will ſtand 6 on *(a)*.

Example.

Suppoſe 952 were to be divided by 14, then ſet 14 on *(b)* even with

952

952 on (*a*), then againſt 1 on (*b*) will ſtand 68 on (*a*) the *Quotient*.

Obſerve here the Dividend hath but one Figure more than the Diviſor, yet the *Quotient* doth conſiſt of two Figures, becauſe the Diviſor doth not exceed ſo many of the firſt Figures of the Dividend. This might alſo have been obſerved in the firſt Example; but in the ſecond it is not ſo, becauſe the firſt Figure of the *Dividend* was leſs than the *Diviſor*, according to the general Rule above given.

This ſhews in all caſes how many Figures muſt be in the *Quotient*; the value of which may be found by the Rules given in Diviſion, afore cited.

But Diviſion is but the reverſe to Multiplication; ſo that at once ſetting the Rule, you may both multiply and divide.

For if 14 be a Multiplicator, ſet 1 on (*b*) againſt 14 on (*a*), this done, againſt any Multiplicand on (*b*) you have the Product on (*a*).

And without moving the Rule, if you ſuppoſe it to be a *Diviſor*, then againſt any *Dividend* on (*a*) you have the *Quotient* on (*b*).

How

How by a *Diviſor* to find a Multiplicator, hath been ſhewn already to do it by the Pen: I ſhall now ſhew how it may be done by the Rule.

Thus having a *Diviſor*, to find a *Multiplicator*, ſet the *Diviſor* given on *(a)* to 10 on *(b)* then againſt 1 towards the left hand on *(a)* is the *Multiplicator* on *(b)*.

Example.

Suppoſe 25 were a *Diviſor* given to find a *Multiplicator*; ſet 25 on *(a)* to 10 on *(b)*, then againſt 1 towards left hand on *(a)* is .04 the *Multiplicator* ſought.

By a *Multiplicator* to find a *Diviſor*; this is but the reverſe of the former: for having .04 a *Multiplicator* on *(b)*, ſet it againſt 1 on *(a)*, then againſt 10 on *(b)* is 25 the *Diviſor*, as before.

As I have before ſhewn by the Pen how to reduce a *Decimal* into a known Part of the Integer, ſo here I will by the Rule ſhew how to do the like; for there is no Queſtion that no Proportional Quality is in it, that is wrought

wrought by the Pen, but it may be done by the Rule.

If the Decimal given be parts of a Pound Sterling, ſet 1 on (*b*) to the number of Shillings, Pence or Farthings contain'd in a Pound Sterling on (*a*); then ſeek the *Decimal* again on (*b*) towards the left hand; and againſt it you have the Shillings, Pence or Farthings reſpectively contained in the *Decimal* given.

Example.

Suppoſe .7625 were to be reduced into its known value; then ſet 1 on (*b*) to 20, the number of ſhillings in a pound on (*a*), then againſt (*b*) towards the left hand is 15.25, that is 15 *s.* 25 parts of a ſhilling, which is equal to 3 *d.* The Analogy or Proportion is,

As 100 to 20, ſo is the two firſt Figures of the Decimal to the ſhillings and parts of a ſhilling contained therein.

Then again, as 100 to 12, ſo is the two firſt Figures of the *Decimal* to the pence contained therein.

As

As in the laſt Example, where .25 parts remained, ſet 100, making 1 in the middle of the Rule an 100; I ſay, ſet 100 on (*b*) to 12 on (*a*), then againſt .25 on (*b*) will be 3 *d.* on (*a*) the value of .25.

Thus you may do in any caſe, only conſider how many of your Denomination doth make one of your Integers; as when the Denomination is Farthings then the Integer is a Penny, when Pence then Shillings, when Shillings then Pounds, *&c.*

The Rule of Three, By the Rule.

In this I ſhall only ſhew the working of it by the Rule; and thoſe that deſire further Inſtructions by the Pen, let me deſire them to ſeek other Authors, from whence they may receive ſatisfaction, for I fear I ſhall exceed my intended Brevity; my preſent deſign being only to explain and ſhew the uſe of a new *Jointed Sliding Rule*, wherein I would be ſo compact, that it may be of a ſmall Purchaſe; for my deſire is, that I may be inſtructive to the meaneſt Mechanicks and honeſt Artificers.

In the Rule of Three, three Numbers are always given, and a fourth in a direct Proportion is required.

The Analogy is; as the first to the third, so is the second to the fourth.

Where note, that the first and third be of one Denomination, so likewise the second and fourth: Also note, that the first and second are of question, the third of demand, and the fourth of answer.

Note also, that the first and third Numbers may be taken on one line, and the second and fourth on the other.

Example.

If 22 men do a piece of work in 20 days, how many days will 8 do the same work in?

Set 22 on (*b*) to 8 on (*a*), then against 20 on (*a*) will stand 55 on (*b*).

Example.

If 140 Tiles lay 2 square of work, how many square will 815 lay.

Set 140 on (*b*) to 815 on (*a*), then against 2 on (*b*) will stand 11.79, which

which ſheweth that if 140 Tiles lay 1 ſquare, that then 815 will lay 11 ſquare, and .79 parts of a ſquare, or 79 foot.

Of the Inverſe Proportion.

Obſerve, that if the third Number be greater than the firſt, then will the fourth be leſs than the ſecond; and contrariwiſe, if the third number be leſs than the firſt, the fourth will be greater than the ſecond: And in either caſe the Rule is thus,

Set the third Number on (*a*) to the firſt, being of like denomination, on (*b*), and then againſt the ſecond on (*a*) you have the fourth on (*b*).

Example.

If 8 men do a piece of work in 9 days, in how many days will 12 men do the ſame work?

Set 12 on (*a*) to 8 on (*b*), then againſt 9 on (*a*) is 6 on (*b*); for 12 men may do the ſame work in 6 days that 8 will do in 9 days.

Hitherto I have ſpoken of numbering; now I ſhall treat of Magnitudes: And firſt,

Of Superficies.

A Superficies is a Geometrical Figure incompaſſed with a line or lines, and is either Round or Angular

A round Figure is that which is contained by one round line, and is either a Circle or Ellipſis.

An Angular Figure is that which doth conſiſt of three or more Angles, from the number of which they are denominated, as a Figure of 3 Angles is called a Triangle, of 4 a Quadrangle, *&c.*

A Triangle is a Superficies comprehended by three right lines. Of the 3, there are ſix varieties which I ſhall forbear to mention, they being meaſured by one and the ſame Rule.

A Quadrangle is a Figure comprehended by four right lines, and is either a Figure Paralellogram or Trapezium.

A Paralellogram hath all its Oppoſite ſides paralel or equal diſtanced, and is either right Angled or Oblique.

A right Angled Parallelogram is either a Square or Oblong.

An

An Oblique Angled Parallelogram, is that whose Angles are all Oblique, and is either a Rhombus or a Rhombodies.

A Trapezium is a Quadrangular Figure, whose four sides are not all equal.

Figures of more sides than four, are almost innumerable, but are reducible into two sorts, regular and irregular, each of which are also called Polygons.

Regular Polygons are such, whose Sides and Angles are all equal, and take their Names from the Number of their sides, as that of five sides called a Pentagon, that of six sides a Hexagon, &c.

Of Irregular Poylgons, 'tis needless to say any thing, they being measured after the same manner as a Trapezium.

I should here next proceed to shew the use of the Rule in measuring of Superficies; but here is first to be noted,

That every Magnitude is to be measured by some known kind o Magnitude, that is Homegeneal orf

like to it, as a line is measured by a line or lineal Inch, Foot, Yard, Ell, or Perch.

A Superficies is measured by a Superficies, or square Inch, Foot, Yard, or Perch.

A Solid by a Solid, or Cubite Inch, Foot, Yard, or Perch.

And when it is known how many { *lineal Inches, or Feet, square Inches or Feet, solid or cubical Inches or Feet* } *are contained in a* { *Line, Superficies, or Solid.* }

Then is the quantity or content of either of these kind of Magnitudes said to be known.

They that desire a more full account of Geometry, let them peruse other Authors: Thus much at present shall suffice for the Theorical Part. Now followeth the Practick, and that only by the Rule, for that is my present design, therefore I shall do nothing but what is done by it.

And

And first of a Circle.

The Area or Superficial Content of a Circle, is found by knowing the Diameter or Circumference: I shall therefore shew, how by knowing either of these to find the other.

Ludolphus Van Culen saith, That the Circumference of a Circle whose Diameter is 10 to be 31.41592536, therefore the Proportion between the Circumference and the Diameter is,

As 10 to the Diameter, so is 31.41592536 to the Circumference, but 31.41 will suffice for our present purpose: Therefore the Circumference being given (for that is most generally first known,) then set 31.41 on the Rule, or the Line *(b)* to the Circumference given on *(a)*, then against 10 on *(b)* will stand the Diameter on *(a)*.

Note, these two Points are marked on the Rule; they being general Centers for this use; the Diameter or 10 with *(d)*, and the Circumference or 31.4159 with a small cutt, and marked with *(c)*.

Alſo the Proportion between the *Diameter* and the *Square* equal, is,

As 10 to the *Diameter*, ſo is 8.862 to the *Square*. And as 10 to the *Diameter*, ſo is 7.071 to the *Square* inſcribed.

And theſe Points are all noted with a ſmall Cutt, and are general Centers for their ſeveral uſes; 8.862 is marked with *(S E)* and 7.071 with *(S I)* ſignifying *Square* equal, and *Square* inſcribe.

So that either *Diameter*, *Circumference*, *Square Equal*, or *Square Inſcribe*, being given, ſet their reſpective Points or Centers to the *Denomination* given, and on the other line againſt each reſpective Center will be the Anſwer: So that having anſwered one, you have all, (a thing not to be done by any other way, either by Pen, or Inſtrument, but this.)

And having as aforeſaid gotten the *Square* equal, you may have the Area or Superficial Content, by multiplying of it into its ſelf, or by the rule; Thus,

Set 1 on *(b)* to the *Square* equal on *(a)*, then again ſeek the *Square* equal

equal on *(b)* and againſt it on *(a)* will be the Area or Content of the Circle required.

But there is yet a more convenient or readier way in finding the Area of the Circle by the Rule: where Note, that the Numbers 785398 and 079578 on the line *(b)*, and noted with 10 ſmall Cutts, and under them both ſtands a mark, thus *(⊙)*; and on the left hand, anſwering the left hand Cutt ſtands *(d)*, ſignifying *Diameter*; and on the right hand anſwering the right hand Cutt, ſtands *(c)*, ſignifying Circumference. Having thus obſerved the Points, then draw the Sliding Piece quite out, and turn him, and put the lines *(b)* and *(c)* together; then to find the Area's of Circles, do thus; if you have the Diameter, then ſet the Cutt *(d)* to 10 on *(c)*, and the Rule thus ſtanding, you have the Area's of all *Diameters* given.

But if you have the Circumference, then ſet the Cutt *(c)* even with 10 on *(c)*; then the Rule thus ſtanding, you have the Area's of all Circumferences given, as before you had the *Diameters*.

Thus look for the Circumference on the line (*c*), then againſt it on the line (*b*) is the Area as before, when the *Diameter* was ſet, then look for any *Diameter* what you pleaſe on (*c*), and againſt it on (*b*) is the Area thereof as was required: But here note, that the (*d*) and (*c*) here mentioned, is them that have the mark (⊙) between them.

But to Illuſtrate this a little by Examples, obſerve firſt; if you have a *Diameter*, and would know the Area, then ſet (*d*) on (*b*) even with 10 on (*c*), and the Rule thus ſtanding.

See this following Table, where you have the *Diameters* on (*c*), then againſt them on (*b*) is their Area's thus:

The Diameters on (*c*)	25	the Area's on (*b*) will be	490.87
	30		709.85
	40		1256.63

Or contrariwiſe, if you have the Area's, and deſire to know the Diameters thereof, then ſeek the Area's on (*b*), and on (*c*), are their Diameters.

As you have done with the Diameter, ſo you may do with the Circumference, ſetting the Cutt (*c*) before deſcribed to 10 on the line (*c*), then againſt the Circumference taken on (*c*) will be the Area on (*b*): Thus,

The Circumference on (*c*)	10	The Area on (*b*) will be	7.95
	9		6.43
	8		5.09

Or the reverſe, as before; if you have the Area, and deſire to know what Circumference that will make, then ſeek the Rule thus ſtanding, the Area on (*b*), then againſt it on (*c*) will be the Circumference required. Or if you multiply $\frac{1}{4}$ the Diameter by $\frac{1}{4}$ the Circumference, you will have the Area thereof.

To meaſure the Segment, or part of a Circle:

Say, as 1 to the Radius or Semi-Circle, ſo is the Semi-Segment or Half-Arch to the Content of that Segment proceeding to the Center, as a Quadrant, a Sextane, &c.

By

By the Rule ſet 1 on (*b*) to the Semi-Diameter on (*a*), then againſt the Semi-Segment on (*b*), will ſtand the Area on (*a*).

But if you would know only what is contained within the curved line, then meaſure the Triangle, and ſubſtract it from the Content, and you have your deſire: Of Triangles I ſhall ſpeak anon; but I muſt firſt ſay ſomething to Ellipſes, or Ovals, they being all one.

Of Ellipſes.

As the Square of the Diameter of a Circle is to the Area of that Circle, ſo is the Product of the greater and leſſer Diameters of the Oval to the Area thereof.

By the Rule thus. Set the number of one of the Diameters of the Oval, it mattereth not which, on (*b*) to the ſame number on (*c*), then againſt the other number or length of the other Diameter on (*b*) will ſtand a mean Proportion, which muſt be meaſured as if it were the Diameter of a Circle, and you will have the Area of the Ellipſe or Oval.

Of

Of Triangles.

In all right lined Triangles,

As 1 to the Perpendicular, ſo is the half baſe to the Content.

Therefore multiply the Perpendicular by half the Baſe, or half the Perpendicular by the whole Baſe, and the Product is the Content.

By the Rule thus. Set 1 on (*b*) to the Perpendicular on (*a*), then againſt the half Baſe on (*b*) will ſtand the Content on (*a*). Suppoſe 50 the Perpendicular, 68 the Baſe, then 1 ſtanding againſt 50, ſeek 34 the half Baſe on that line you counted 1 on, and againſt it on the other will be 1900, the Content of that Triangle.

Or if you had ſet 1 on (*b*) to 25 on (*a*), then againſt 68 on (*b*) would be 1900 on (*a*) as before.

Or thus,

As 2 to the whole Baſe or Perpendicular, ſo is the whole Baſe or Perpendicular to the Content.

Therefore ſet 2 on (*b*) to the Perpendicular or Baſe on (*a*), then ſeek the other on (*b*), and againſt it on (*a*) will be the content required.

Of

Of measuring Squares.

This is only to multiply one side by the other, and the Product is the content. Thus,

Suppose one side 20, the other 30, then set 1 on (*b*) to 20 on (*a*), then seek 30 on (*b*), and against it on (*a*) will stand 900 the content.

Of Trapeses.

As 2 to the Diagonal Line from any 10 corners of a *Trapesia*, so is the Sum of the two Perpendiculars to the Area.

Thus suppose the Diagonal 23, and one Perpendicular 8, the other 7, which put together make 15; therefore set 2 on (*b*) to 23 on (*a*), and against 15 on (*b*) will stand 175 the Superficial Content of the Trapesia.

Of Polygons.

As 2 to the measure of the sides of a Polygon, being added together, so is the Measure from the middle of one side to the Center; I say, as 2 is to the measure of the sides, so is this measure to the Superficial Content.

The

The manner of Irregular Figures are beſt meaſured by reducing them into *Triangulars* or *Trapeſias*.

Hitherto I have treated Theoretically; now I will ſhew you the Practical Part, of what I have ſaid, and firſt of the Superficial Part.

Of meaſuring by the Square.

When the dimenſions are given in feet, ſuppoſe a Floor to be 25 foot long and 16 foot broad, I deſire to know how many Squares of Flooring there is. This is done by multiplying one ſide by the other, or by the Rule. Thus,

Set 1 on (*b*) even with 16 on (*a*), then ſeek 25 on (*b*), and right againſt it on (*a*) will ſtand 400 or 4 Squares, one content required. Again, ſuppoſe I have a Roof to meaſure that is 25 foot long, and 15 deep, I deſire to know the content in Squares, then I ſet 1 even with 15, then ſeek 25, and right againſt it will be 475 foot, or 4 ſquare, and 75 foot or $\frac{3}{4}$ of a ſquare. But now, becauſe in a Roof is double, therefore when you have found

found 475 being on one ſide, draw your Rule, and ſet 1 even with 475, then againſt 2 will ſtand 940, or 9 Square, and 40 foot the content required.

Again, ſuppoſe it were a *Gable End* or *Triangular Piece*, you were to meaſure; then,

Set 2 on (*b*) even with the length of the Perpendicular on *a*); as ſuppoſe 12, then ſeek the length of the Baſe on (*b*, as ſuppoſe 24, then againſt it on (*a*, will ſtand 144, or 1 Square, 41 Foot, the content required.

Of meaſuring by the Foot, Yard, when the Dimenſions are given in Feet.

This is done by multiplying the ſides one into the other, and dividing by 9, or by the Rule. Thus,

Suppoſe a piece of Plaiſtering be 15 foot one way, and 23 foot the other way, I deſire to know how many Yards of Plaiſtering there is in it.

Note, that 9 is a general Center for Yard Work, or to give the content in Yards and Parts of a Yard, when the Dimenſions are given in feet; therefore ſet 9 on (*b*) to one ſide,

ſide, *viz.* 15 on (*a*), then ſeek the other ſide on (*b*), *viz.* 23, and juſt againſt it will ſtand the content in Yards and Decimal Parts, of a Yard, *viz.* 38 Yards, 33 Parts of a Yard or $\frac{1}{3}$.

Again, ſuppoſe a Room of Wainſcot be 55 foot about, and 11 foot deep, I deſire to know how many Yards of Wainſcot there is.

I ſet 9 to 11, then againſt 55 I have 67 Yards, .22 Parts, the content required.

But if your Wainſcot had been a *Triangular*, then inſtead of 9 you might have made uſe of 18, and ſo have meaſured by the Baſe and Perpendicular, as you did in meaſuring of Squares; or elſe, when you had done by 9, then have took $\frac{1}{2}$ of the Sum.

Of meaſuring by the Foot, when the Dimenſions are given in Inches and Feet.

As ſuppoſe a Board or other thing were 22 Inches broad, and 15 foot long, then note for this .12 is a general Center; therefore ſet the length thereof on (*b*) to 12 on (*a*), then againſt

againſt the breadth in Inches on (*b*), will ſtand the content in feet on (*a*).

Thus, ſet 15 the feet in length on (*b*) to 12 on (*a*), then againſt 22 the breadth in inches on (*b*) will ſtand 17 foot 6 parts on (*a*), the content required in the ſaid Board.

Of Land meaſure when the Dimenſions are given in Perches or Roods.

Then ſet 160 to the length; then againſt the breadth will be the content in Acres.

As ſuppoſe a piece of Ground were 25 Perches one way, and 37 Perches the other way; then ſet 37 on (*b*) even with 160 on (*a*), then ſeek 25 on (*a*), and againſt it on (*b*) will ſtand 5 Acres 78 parts, the content of the piece in Acres and parts: But if in this or any other, you deſire to know how much the Decimal Part doth ſignify of the whole Number, do thus; tho' this I have ſpoken of before, yet for Illuſtration I will note it again: Therefore, firſt note, how many of your Denomination maketh one Integer, then ſet that to 100, and againſt the parts propoſed, you have the

the known value of the Decimal.

Thus in the laſt Example of Land, I hold 78 parts of an Acre: Then by the Rule,

Set 160 on (*b*) the Perches in one Acre, even with 100 on the end of the line (*a*), then ſeek the Decimal on (*a*), *viz.* 78. and againſt it on (*b*) I find 124.8, which telleth me, that 78 is 124 Perches, and 8 parts of a Center; which to know then, becauſe 1 Perch doth contain 272 feet and $\frac{1}{4}$, therefore I ſet 272.25 on (*b*), even with 100 on (*a*), then I ſeek 8 on (*a*), I find 21.78; ſo I find it to be 21 feet, 78 parts of a foot; then again, becauſe 144 inches make 1 foot, therefore I ſet 144 to 100, then againſt 78 I find 112 inches and 32 parts of an inch. And thus, if you deſire, you may go on to quarters, and half quarters of inches, conſidering that in one inch was 16 $\frac{1}{4}$, and in $\frac{1}{2}$ one $\frac{1}{4}$ 4 half quarters.

The like you may alſo do by any thing elſe, as I ſaid before, conſidering how many of your denomination maketh one Integer.

As in that of Yard Meaſure, the

ſecond

ſecond Example, I had 22 parts, then I ſay, that becauſe 9 feet make 1 Yard, therefore I ſet 9 to 100, and then ſeek for 22 on (*a*), and againſt it ſtands the feet and parts of a foot on (*b*) contain'd in the Decimal, *viz.* 1 foot, 98 parts of a foot.

Of meaſuring of Glaſs by the Rule.

Suppoſe a Pain of Glaſs be 3 foot 25 parts deep, 1 foot 5 parts broad, what is the content of that Pain of Glaſs?

Set 1 on (*b*) to the breadth, *viz.* 1.5 on (*a*), then ſeek the depth, *viz.* 3.25 on (*b*), and againſt it will ſtand 4.86, the content of the Pain of Glaſs; and to know what this 86 is, you may know by ſetting 144 to 100, and working as I have ſhewed before.

But note, in the taking of Dimenſions, that becauſe they are moſt times taken in feet and inches, or twelfth parts of a foot; and the lines by which theſe things are anſwered, are divided into tenths; therefore I have divided the foot into 10 equal parts, and each of them into 10 equal parts more; ſo that the foot

is

is divided into 100 parts, and I have placed this line juſt by the line of inches; ſo that by inſpection only you have the Decimal when it was given in inches. Thus,

Suppoſe 2 foot 3 inches, then againſt 3 Inches I have .25; ſo that the parts are .25. So againſt 6 inches is .5 or 50, being $\frac{1}{2}$; and againſt .75 is 9 inches or $\frac{3}{4}$ of a foot; and ſo you may do in any other.

Having one ſide given to find how much the other muſt be, to make one Square on Yard, on Acre, or on foot Superficial.

This is done by dividing of the whole integer by the ſide given, and the Quotient will be the other ſide; or by the Rule,

Thus, ſet the ſide given to the whole integer, then againſt 1 on that line, will be the other ſide on the other line.

Thus, ſuppoſe I have 25 foot given, and deſire to know how many foot muſt be the other ſide, to make a Square or 100 foot, then I ſet 25 foot on (*b*) to 100 on (*a*), then againſt 1 on (*b*) will ſtand 4 on (*a*), the other ſide deſired. Again,

Again, ſuppoſe I had 5 foot given, and deſire to know how much muſt be the other ſide to make a Yard, then I ſet 5 the ſide given on (*b*) to 9, the feet in one Yard on (*a*), then againſt 1 on (*b*) will ſtand 1.8 the other ſide, to make a Yard Superficial.

Again, ſuppoſe 25 inches were the breadth of a Board, how many in length to make a foot of Board?

Then ſet 25 the ſide given on (*b*) to 144 the Inches in a foot on (*a*), then againſt 1 on (*b* will ſtand 5.76 the other ſide required: The like you may do in other like caſes.

Hitherto of Superficies, now of Solids; in the meaſuring of Superficies, we have made uſe only of the 10 lines of double Radius, but in Solids you muſt uſe one of the lines of double Radius, *viz.* that on the looſe piece, with a line of ſingle Radius, and this is on the inner ſide of the leg, and is marked with (*c*).

Of meaſuring of Timber by the Rule.

Of hewed or ſawed Timber, you muſt have the Square Root, or true Square

Square of the Piece before you can measure it. Now because *Timber* most times is broader one way than the other, it is generally added both together, and the half of the same taken for the Square of the Piece; but that may be greatly erroneous if there are much difference, or one much more than the other.

But to find the true Square of a Piece, when one side is much more than the other; multiply one side into the other, and then find a number, that being multiplyed into it self, may make the same Product as the other 2 unequal sides did, and this is called extracting the Square Root; but I shall forbear that here, and shew how it may be done by the Rule. Thus,

Multiply the 2 unequal sides one by the other, as I have taught in Multiplication by the Rule; then keep the Product in mind, and set the line of double Radius, *viz.* (*b*) even with the line of single Radius, *viz.* (*c*), then the Rule thus standing, seek the Product of your 2 sides beforementioned, on the line of double Radius's

dius, *viz.* (*b*), then againſt it on the line of ſingle Radius, *viz.* (*c*), will ſtand the Square Root, or equal ſide of the piece deſired.

Example.

Suppoſe a piece to be meaſured by Solid Meaſure, were only 2 inches thick, and 18 inches broad; then I multiply 2 by 18, and the Product is 36, then the line *b*) ſtanding even with the line (*c*), I ſeek for my Product, *viz.* 36 on (*b*), and againſt it on (*c*) I find 6, the ſide of a Square equal to that of 2 and 18; for 6 times 6 makes 36, as 2 times 18 did. But had this been ſquared by taking the half of the 2 ſides, being added together, as the general way is, it would have made 10 inches ſquare, when indeed it is but 6; a Grand Errors.

But a more convenient and ready way is, to ſet the 2 ſides, counting one on (*b*), the other on (*c*) even, then ſeek the other ſide on (*b*), and juſt againſt it on (*c*) is the Square equal required.

Example.

Suppoſe 7 inches thick, and 27 broad, then I ſet 7 on (*b*) even with

7 on (*c*); then the Rule thus ſtanding, I ſeek for the other ſide, *viz.* 27 on (*b*), and juſt againſt it will ſtand 13.748 on (*c*).

Or, ſet 27 on (*b*) even with 27 on (*c*), then againſt 7 on (*b*) will ſtand 13.748 on (*c*), as before.

Now having ſquared your piece: Proceed thus,

Set the length of the Piece on (*b*) to 12 on (*c*), then ſeek the ſquare on (*c*), and againſt it on (*b*) will be the ſolid content.

And becauſe 12 is a general Center for Timber Meaſure, therefore I have noted it with a Braſs Pin or Center on the left hand end of the line, and ſerves for all Timber that is above 10 inches ſquare; but if it be leſs than 10 inches ſquare, then you muſt make uſe of that 12 on the right hand end of the Rule, and is marked with the Number 12. Having well premiſed all theſe things, you will be inabled to proceed to the meaſuring of any Square Timber.

Example.

A piece of Timber 15 inches ſquare, and 20 foot long, How much Timber is in that Piece?

Set 20 the feet in length on (*b*) to the Braſs Pin on (*c*), then ſeek 15 the inches ſquare on (*c*), and againſt it on (*b*) is 31 foot 33 parts.

And now to know what the 33 parts are of the whole integer or foot, do thus:

Set 1728 on (*b*), the inches in one ſolid foot to 100 on (*a*), then againſt 33 on (*a*) will ſtand 570.24 the inches on (*b*).

Again, ſuppoſe a piece to be 13 foot long, 6 inches ſquare: Then ſet 13 the length in feet on (*b*), to the number 12 on (*c*); then towards the left hand on (*c*), I ſeek 6, and againſt it on (*b*) I find 3.25, or 3 foot and ¼.

To meaſure Timber, having the Diameter given.

Then inſtead of the Centers 12, uſe 13.54, and make that a Center; then ſet the length on (*b*) to 13.54 on (*c*), then ſeek the Diameter given on (*c*), and againſt it on (*b*) will be the content in feet, and parts of a foot.

To measure Timber, having the Circumference given.

Then instead of 12, use 42.54 for a Center; and set the length on (*b*) to 42.54 on (*c*), then against the Diameter on (*c*) is the content on (*b*) in feet and parts of a foot.

Note, here is another Error used among Measurers of Round Timber, that is, they take a fourth part of the Girt for the side of a Square equal to that piece: As suppose the Girt 60 inches, then they account 15 to be the square of it, when indeed it is near 17 inches square; but sometimes custom goes beyond truth and reason: Therefore I shall say no more of it.

Of measuring a Cone.

As 1 to the Area of the Base of a Cone in inches, so is one third part of the Altitude in inches to the solid content of the Cone in Cube Inches.

This is answered by the lines (*a*) and (*b*), or as 1.128 to the Diame-

ter or Baſe in Inches, ſo is one third of the Altitude to the content in inches; this is wrought by (*a*) and (*b*) at twice, or by (*b*) and (*c*) at once.

Of a Globe.

The proportion between a Globe and Cylinder of the ſame Diameter, and the Altitude with the Globe is,

As 2 to 3, ſo is the ſolid content of a Globe to the ſolid content of a Cylinder of the ſame Baſe and Altitude of the Diameter of the Globe.

So that when you have the Diameter of your Globe, compute the content of it, as if it were a Cylinder of that Diameter and Altitude, equal to the Diameter; which you may do by what hath been ſaid before. Then,

Set 2 on (*b*) even with 3 on (*a*), then ſeek the content of the ſuppoſed Cylinder on (*a*), and juſt againſt it on (*b*) will ſtand the content of the Globe required.

I ſhall make this a little more plain by an Example. Thus,

Sup-

Suppoſe I had a Globe whoſe Circumference is 31.141; then by the Rule, I find that the Diameter is 10, the Square equal 8.862, and from that the Area or Superficial content 78.54, and then this Area I multiply by 10, being the Altitude equal to the Diameter; and it is 785.4; then by the Rule I ſet 2 on (*b*) to 3 on (*a*), then I ſeek 785.4 the Cylinders content on (*a*), and againſt it on (*b*) I find 523.4, the Cubical content of the Globe, as was required.

Or you may meaſure a Globe thus: Cube the Diameter; then the Analogy is,

As 21 to 11, ſo is the Cube of the Diameter to the Solid Content of the Globe.

Note, to Cube a thing, is to multiply the number given by or into its ſelf, and the Product by that number again: As ſuppoſe I deſire to know the Cube of 4, then multiply 4 by 4, and it maketh 16; then this 16 again by 4, and it produceth 64, the Cube of 4.

This is eaſily done by the Rule; but ſeeing I have ſhewed Multiplication

cation by the Rule already, therefore I ſhall forbear to give an Example here.

There are many more varieties belonging to the Numeration of Globes, Cylinders, Cones, and alſo other ſolid Irregular Bodies, too large here to be treated of; I therefore omit them.

Of meaſuring Bricklayers Work.

Note, that Bricklayers generally meaſure by the Rod ſuperficial, and a Brick and half thick, they call true Wall: Therefore, if the Wall be more or leſs, they reduct it to that thickneſs; which to do there are ſeveral ways; but I ſhall ſhew only this one, firſt by Pen, then by the Rule.

By the Pen, multiply the length by the height, and divide the Product by 272.25, whoſe Quotient will be the Superficial content in Rods: Then ſay,

As 3, the number of half Bricks to make a true Wall, to the number of half Bricks contained in the thickneſs of the Wall, ſo is your Superficial Content to the Content of the Wall reducted to its true Thickneſs.

By

By the Rule: Thus, noted That 272.25 is the ſuperficial feet contained in a Rod or 16.5 ſquare: therefore make that a Center. I have diſtinguiſh'd it with a ſmall Cutt, and marked it with (*B*) for Bricklayers work on the line (*b*); then I ſet the Center (*b*) to the feet in length, and then ſeek the feet in breadth on the line (*b*), or that whereon the Center was counted; and againſt it on the other, or the line (*a*) will ſtand the content in Rods and Decimal Parts, which keep in mind; then note 3 as another Center of Reduction, which 3 on (*b*) ſet to the number of half Bricks thick that the Wall is of, then on (*b*) ſeek your former reſerved content, and againſt it on (*a*) will ſtand the content of the ſaid Wall reduced to its true Thickneſs.

Example.

Suppoſe a Wall to be 21 foot high and 42 foot long, and 3 Brick, or 6 half Bricks thick.

Then I ſet the Center, *viz.* 272.25 on (*b*) to 21 the depth on (*a*), then I ſeek 42 the length on (*b*), and a-

gainſt it on (*a*) I find 3 Rods .24 Parts. This then I reſerve, ſince the Wall was 6 half Bricks thick. I ſet 3 on (*b*) the Center for Reduction, to the 6 half Bricks thick on (*a*), then againſt 3.24 the reſerved number, I find 6.48 the content in Rods and Decimals of the afore propoſed Wall; and to know what this .48 parts to make of a Rod, do thus, as I have taught by other Decimals.

Set 272.25, the number of feet in one Rod to 100, then againſt .48 will be 130.68, the feet and parts of a foot; ſo that the Wall of 21 and 42 and 6 half Bricks thick doth contain 6 Rods 130 foot and 68 parts of a foot.

Of meaſuring of Stone.

This is meaſured by the foot ſolid, and therefore there is no difference from that of Timber, therefore I ſhall ſay no more of that.

Theſe preceding lines being well premiſed and underſtood, I dare preſume thou wilt be moderately qualified for the menſuration of any work whatſoever that belongeth to any

any Mechanical Artificer, and having computed the quantity in whole or part of the work done, or to be done; in the next place, it will be convenient to count the value or worth of the whole or part, which take as followeth:

The Analogy is thus,

If 1 Foot, Yard, ſquare, Perch or Rod be worth ſo much, then ſo many Feet, Yards, Squares or Rods, and parts or part of one ſhall be worth ſo much, or by the Rule thus; ſet the ſum of the Price of 1 Foot, &c. to 1 Foot, &c. then ſeek number of Feet, or Feet and parts, or parts alone, &c. and againſt it will ſtand the Sum deſired.

Example.

Suppoſe Brick-work at 5 *l.* 5 *s.* per Rod, what will 19 Rods come to, 99 *l.* 15 *s.* Thus ſet 1 Rod to 5 l. 5. *s.* the price of one Rod, then the Rule thus ſtanding, you have the price of any other quantity of Rods or Parts, at the price propoſed; ſo here, 1 on (*b*) ſtanding againſt 5 *l.* 5*s.* on (*a*)

then againſt 19 on (*b*) will ſtand 99 *l.* 15 *s.* on (*a*) and againſt 8.5 Rods will ſtand 49 *l.* 17 *s.* 6 *d.* and againſt 4.25 Rods will ſtand 28 *l.* 18 *s.* 9 *d.* and againſt 2.125 Rods will ſtand 14 *l.* 9 *s.* 4 *d.* $\frac{1}{2}$ and againſt 1. 625 Rods will ſtand 7 *l.* 4 *s.* 8 *d.* $\frac{1}{4}$ and ſo of the reſt.

Another Example.

Suppoſe Flooring at 15 *s.* per ſquare, then I ſet 15 on (*b*) to 100 on (*a*) then againſt 25 foot on (*a*) will be 3.75 or 3 *s.* 9 *d.* as you may prove by the Rule, that 75 parts of a Shilling is 9 *d.* And here note, that always the prime or great Diviſion, where the Figures ſtand, is ſo many whole Integers, and the others are parts; except you make the 1 in the middle of the Rule to be but one Integer; then all the Primes are tenth parts; as ſuppoſe you deſired to know what 5 foot came to at the Rules before-mentioned; then againſt 50, which now muſt be reckon'd but 5, otherwiſe you will be off the Rule, then againſt 5 on (*a*), will be .75 on (*b*)

on (*b*) which is .75 parts; and againſt 4 foot will be .6 tenth parts.

In like manner, you may do by others, as ſuppoſe Sawyers work at 3 *s.* a hundred, then ſet 3 *s.* or 36 *d.* and then your Anſwer will be pence, and parts of a penny; as you will find that 25 foot cometh to 9 *d.* 20 foot 7 *d.* 8 foot 2 *d.* .51. 5 foot 1 *d.* .79 3 foot 1 *d.* .08, *&c.*

Of ſimple Intereſt.

Of what hath been ſaid before, of computing the value of Work, may be underſtood of this one, and the ſame Rule anſwering both; for you may ſay, as a 100 *l.* to the uſe of a 100 *l.* ſo is more or leſs Principal to more or leſs Uſe; thus, at 6 *l. per Cent per Annum*, what will 25 *l.* come to? *viz.* 1 .5 *l.* or 30 *s.* and ſo the Rule thus ſtanding, you will have the Intereſt of all Sums at that Uſe, or at any other Uſe, ſetting the Uſe on (*b*) to 100 on (*a*).

But if you deſire to know what ſuch a ſum will come to in ſuch a time, and at ſuch Intereſt; then having by the former Rule found the whole

whole Uſe for one Year, or twelve Months, then ſay, if twelve Months make that Uſe, what will ſo many Months give or make? Or you may put Uſe and Principal together and work.

Example.

What will 150 *l.* come to in ſix Months, at 6 *l. per cent. per Annum*; then by the firſt Rule, I find that 150 *l.* cometh to 9 *l. per Annum*; then if 12 Months come to 9 *l.* what will 6 Months come to? Then ſet 9 *l.* on (*b*) to 12 Months on (*a*), then againſt 6 Months on (*a*) will ſtand 4.5 *l.* on (*b*), which is 4 *l.* 10 *s.*

Of Gauging.

IN *Gauging* I ſhall be very brief, only inſert a few Notes, and leave the reſt to the Induſtrious and Ingenious Practitioners: Firſt, note in a Wine Gallon is contain'd 231 Cube Inches; in Bear or Ale, 282 Cube Inches; alſo note that 32 Gallons make one Ale Barrel; and 36 of the ſame Gallons, make a Beer Barrel; but theſe Tables will larger and better inform you.

A Table of Beer Meaſures.

Inches.	*Pints.*				
354½					
706½	2	*Qts.*			
282	8	4	*Gallons.*		
2538	72	36	9	*Firkins.*	
5076	144	72	18	2	*kild.*
10152	288	144	36	4	2 *B.*

A Table of Ale Measure.

Inch.	Pints	Quar	Gal	Firk	kil	Bar.
35¼						
70½	2	Quar				
282	8	4	Gal			
2255	64	32	8	Firk		
4512	128	64	16	2	kil	
9024	156	128	32	4	2	Bar.

A Table

A Table of Wine Measure.

Inches								
$28\frac{7}{8}$	Pints							
$57\frac{3}{4}$	2	Quar						
231	8	4	Gal					
4158	144	72	18	Rund.				
14553	504	252	63	$3\frac{1}{2}$	Hogsh.			
19404	672	336	84	$4\frac{2}{3}$	$1\frac{1}{3}$	Terc.		
29106	1008	504	126	7	2	$1\frac{1}{2}$	Pipe	
58212	2016	1008	252	14	4	3	2	Tun.

This

A Table of Ale Measure.

Inch.	Pints	Quar	Gal	Firk	kil	Bar.
35¼	Pints					
70½	2	Quar				
282	8	4	Gal			
2255	64	32	8	Firk		
4512	128	64	16	2	kil	
9024	156	128	32	4	2	Bar.

A Table

A Table of Wine Measure.

Inches	Pints	Quar	Gal	Rund.	Hogsh.	Terc.	Pipe	Tun.
28 7/8								
57 3/4	2	Quar						
231	8	4	Gal					
4158	144	72	18	Rund.				
14553	504	252	63	3 1/2	Hogsh.			
19404	672	336	84	4 2/3	1 1/3	Terc.		
29106	1008	504	126	7	2	1 1/2	Pipe	
58212	2016	1008	252	14	4	3	2	Tun.

This

This Table ſheweth, that in one Tun is two Pipes; 3 Tercions; 4 Hogs-heads; 14 Rundlets; 252 Gallons; 1008 quarts, 2016 Pints, and 58212 ſolid Inches. The Tables of Beer and Ale are like this, and need no Explanation.

Note that on the Line of ſingle Radius or Line, are to be noted theſe centers or Gauge Points, *viz.*

For Wine Gallons at 17.15.
For Ale Gallons at 18.95.
For Ale Barrels at 107.20
For Beer Barrels at 113.69.
For Cube Inches at 1.128.

Note theſe are for round Veſſels, therefore ſet the length of the Veſſel in Inches, counting them on *(b)*, to theſe ſeveral Gauge points on *(c)*, then the Rule thus ſtanding, ſeek the Diameter on *(c)*, and juſt againſt it on *(b)*, will be the content according to the Gauge Point made uſe of.

Example.

Suppoſe 40 inches long or deep, and 28 Diameter, then ſet 40 on *(b)* to 17.15 the Gauge Point for Wine on *(c)*; then ſeek 28 the Diameter on

(c),

(*c*), and againſt it, you will find 107 on (*b*), the content in Wine Galons, as the Point made uſe of mentioned. Do the like by the reſt, and you will have the Anſwer on (*b*), as I ſaid before, according to the Point uſed: As ſetting 18.95 to 40, will anſwer 87.75 Ale Gallons, and ſo the reſt, *viz.* 2.74 Ale Barrels, 2.43 Beer Barrels, *&c.*

But note, this is when the Veſſel is a true Cylinder; but moſt generally Liquid Veſſels are not made Cylindrical, but bowing in the middle: therefore before theſe Veſſels can be truly Gauged, there muſt be a mean Diameter found, that may reduce the ſaid Bulking Cask into a true Cylinder; which to do, there ought to be conſideration had to the quantity of the bowing of the Cask; for the more he boweth, of neceſſity the greater muſt be his Cavity, and by conſequence hold the more: And on this account Authors have ſuppoſed, that all Casks do come under theſe four Denominations, or Solid Forms, *viz.*

Either firſt, a *Spheroid.*

2. *Parabolical Spindle.*

3.

3. Two *Parabolical Conoids.*

4. Or two *Cones*, abutting upon one common Base. And have laid down Rules for finding the content of these Solids.

But if all Casks of like Dimensions should be measured by these Rules, yet there might be a considerable Error; for between a *Parabolical Spindle*, and *Parabolical Conoid*, there is a considerable difference; so that several Casks may come between these two; so that if they were measured by either of these Rules, there would be a considerable Error.

As suppose a Cask of these Dimensions, the head Diameter 24 inches, the Bung Diameter 34 inches, the length 48 inches: Now a Cask of these Dimensions being measured as a *Parabolical Spindle*, would contain 127.64 Gallons; and being measured as a *Parabolical Conoid* would contain 115.77 Gallons, so that 115.77 being substracted from 127.64, the difference would be 11.87 Gall. which is almost 12 Gall. and then suppose a Cask to be just mid-way between these two forms, would by consequence contain

contain near 6 Gallons, either more or less; a considerable Error.

Again, on the other hand, between a *Spheroid* and *Parabolical Spindle*, there is so little difference, that I believe no man will pretend to distinguish, which Notion the Cask must be taken in, whether as a *Spheriod* or *Parabolical Spindle*; for between these two, there is but about 1 Gallon in 128 Gallons difference: Therefore these Rules are not sufficient to measure all Casks by, but a more nearer Observation ought to be taken, and more agreeable Rules practised; but these things with the whole Art of *gauging* are too large here to be treated of, for that would take up more than all this Book, whereas I intend only to compose a small Volume, that it may not exceed the purchase of every one that is a well-wisher to the Art of Measuring: For I am well assured, that there are many that would willingly have some knowledge in the said Art that have not 5 or 6 *s.* that they can spare, for each particular Branch; and perhaps those, tho' not so full of Mony, as deserving

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ing as others: I ſay, for their ſake I have compoſed this ſmall Tract, and if they deſire to be further inſtructed in the ſaid Art of Gauging, or any other part herein mentioned, I ſhall be willing and ready to ſerve them truly and faithfully.

But becauſe I would not willingly leave you totally ignorant of proportioning the Diameters of Casks, I will give you this ſhort and eaſie Rule, which is thus: Subſtract the Head Diameter from the Bung, and add two third parts of the difference to the Head, or Subſtract one third from the Bung. Thus,

Bung 20 Inches
Head 17 Inches

Difference 3 Inches

Two thirds 2 Difference

Added to 17 the Head makes 19 the mean Diameter.

For

For Square Veſſels, the Gauge points are.

For a Beer-Barrel at 100.76.
For an Ale-Barrel at 95.

Then if your Veſſel be true Square otherwiſe; find a Square equal to both ſides, as hath been ſhewn in Squaring of Timber; then ſet the Gauge Point on (*c*) even with the depth of the Liquor to be Gauged on (*b*); then juſt againſt the Square on (*c*) will ſtand the content in Ale or Beer-Barrels, as you uſed the reſpective Gauge points.

Thus much at preſent ſhall ſuffice for the uſe of the *Sliding-Rule*. I ſhall now proceed to ſhew the uſe of ſome other uſeful Lines placed on the ſaid *Joynted-Rule*, which do particularly belong to Carpenters; and if duly conſidered and rightly applyed, may be to them of ſingular Benefit.

The Use of the Scale of Scales, or Universal Scale.

THis Scale is placed on the inner-side of both the Legs of the Rule, and beginneth with one at the Head of the Rule, beginning both of them in the center or middle of the Head revet, and so continued on both legs to 30, and is equally divided, signifying 30 foot, and each foot or equal part is again divided into 12 parts, signifying inches; and note also, that the said Scale is again repeated on the under-side of the loose or Sliding-Piece, and is to be used Secter-wise, or from Leg to Leg; and from this sectoral operating, proceeds the universality of the Scale; for hereby you have a Scale of all Magnitudes, either great or small; also hereby you have a Scale fitting all Draughts, and tho' you have not, nor never see the Scale by which the said Draught was protracted; also hereby you may from a small Draught have a Scale to protract a great one, or the contrary.

Note,

Note on the loose-piece is also a line of Chords to 180 degrees whose use is to set the Rule to any desired Angle.

Thus for Description; now for the use.

Suppose I have a line of unknown length given, however this line must represent 10 foot and a Draught, thereby protracted proportional; then note the length of the unknown line on the loose-piece, then set the small Joggle at 1 on the loose-piece to 10 on one Leg, and open the Rule with the place that noted the length of the unknown line, just reach 10 on the other Leg; then the Measure from any other Number on one Leg taken with the said loose-piece to the same unmber on the other Leg, will be the true Measure of the number desired.

Example.

Suppose I have a line whose length is unknown, but I find that the length is just equal with 13 on the line of 30 on the loose piece, and this line I would have represent 20 foot. Then.

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I ſet the Joggle to 20 on one Leg, then ſet 20 on the other Leg to 13 on the looſe piece; ſo is the Scale ſet. Then, let the Rule remain thus unremoved, and you have all other Dimenſions agreeable to the ſaid Scale, taking the diſtanee with the looſe-piece from any Number on one Leg to the ſame Number on the other Leg, as here you will find that between 10 and 10 will be 6½, or ſix and a half; between 5 and 5, will be 3 and a quarter, or 3 foot 3 Inches, and between 15 and 15 will be 9 foot 9 inches, *&c.*

To divide a line into any number of Parts.

Note the length of the given line on the looſe-piece, then note the parts you would have it divided into, and ſet the Joggle to it on one Leg, and make the ſame parts on the other Leg, juſt touch the Point, repreſenting the length of the line on the looſe-piece; then the diſtance between 1 and 1, will divide the line into the number of parts required.

Example.

Example.

Let 6 Inches be to be divided into 9 equal parts; then note 6 Inches on the looſe piece, and make it a parallel in 9 and 9, then the parallel of one and one will divide the 6 Inches into 9 equal parts.

Note by parallel, I mean, from Legg to legg, and therefore I would have you note it, for I ſhall uſe it often, and perhaps not tell you the meaning of it any more.

Or if you make the Line a parallel in 27, and 27, then take out the parallel of 1 inſtead of 1, and that will do it better.

To lay down or draw a Line to repreſent any number of Feet and Inches required.

Take the number given from any Scale of equal parts, and that ſhall be a Line ſo required to that Scale; but if the Scale be too large, or too ſmall; as ſuppoſe 4 Inches repreſent 30 Foot, then count the length of 4 Inches on the looſe piece, and make it a parallel in 30 and 30, then any other parallel number will anſwer your deſire, as I have ſpoken before.

But now, becauſe I find that on the looſe piece will be occaſion of having a Line of Inches; I will, If I had room, place it thereon, or elſe prick out the Inches with ſmall pricks, which I muſt pray you to accept of inſtead of a plainer, which I am forced to omit for want of room.

Any two Lines given, to find their proportion one to another.

As ſuppoſe 5 Inches be called 10 Foot, what will 8 Inches be called then?

Count 5 Inches on the looſe piece, and make it a parallel in 10 and 10, then carry the looſe piece along, till 8 Inches ſtay in like parts on both Leggs, which will be only in 16 and 16; therefore theſe Lines of 5 and 8 are in like proportion, as 10 and 16; but this might have been anſwered by the ſliding Rule; ſaying as 5 to 10, ſo is 8 to 16.

Alſo by theſe Lines may be anſwer'd any Geometrical proportion: And alſo the rule of Three; and ſeveral other Arithmetical Queſtions may be reſolved hereby; but ſeeing that

that is done by the ſliding Rule, which I take to be alſo more convenient for that purpoſe; not intending or deſiring to write one thing twice; therefore I ſhall here omit that, and paſs on to ſome other things that may be found out, and performed by theſe lines, which the *Sliding Rule* will not ſo readily do.

Alſo the meaſuring of Timber either ſquare, or round, or broad, may be done by theſe lines; but that I alſo leave to the *Sliding Rule*, as being moſt proper; and tho' that be as I conceive moſt proper for the meaſuring of your Board and Timber, I judge this to be moſt convenient in directing you in the converting and cutting your Timber; ſo that you may convert and cut it to little or no waſte: for hereby you may find the juſt length of every particular piece, if you well conſider it; as thus:

Suppoſe you were to frame a Roof that muſt have 12 foot perpendicular, and the breadth of your Frame were 20 foot, then what muſt be the length of the Rafters?

Then do thus: Set the Rule to a Square or true Angle, by making the Chord of 90 degrees a Parallel in 15, and 15, then count the half width on one leg, *viz.* 10. and ſet the Joggle on the looſe piece to 10 on one leg, and keep it there, then move the other end, till it come to the Perpendicular, *viz.* 12. and what parts that Cuts on the looſe piece, that is, the length of the Rafter required.

Or, if you have the Rafter and width to find the Perpendicular, then the Rule thus ſtanding at right Angles, count the Rafters length on the looſe piece, and the half width on one leg, then place the Joggle to the half width, and then ſet the Rafters length on the looſe piece, to touch the other leg, then that ſhewe th the Perpendicular required; for this is but the reverſe to the former; or it may be done thus, Count the whole width of the Frame on one leg, then count the length of the Rafter on the other leg, and alſo on the looſe piece, then ſet the Joggle to the width, and make the length of the Rafter touch each

each other, both on the looſe piece, and other leg, then take the diſtance between the length of the Rafter, and the half width, and that is the Perpendicular required.

And the Rule thus ſtanding, you have the Bevel to cut the foot of the Rafter to ſtand on the Beam; or by this Bevel you may cut the foot of the ſingle Rafters to ſtand on the Poul-Plat.

To find the length of the hips or ſteepers, ſet the Rule to a right Angle, as hath been taught before, then count the half width on one leg, and the Rafters length on the other leg, then take that Parallel diſtance, and you have the hips length on the looſe piece.

To ſet the Rule to the Bevel of the foot of the hips, do thus; count the hips length laſt found on one leg, and the half width on the other leg, then ſet the Joggle on the looſe piece to the half width, and count the Rafters length on the looſe piece, and make it a Parallel between the half width and hips length, then the Rule ſtands to the beave of the foot

of the hip; note, this Bevel must be laid both ways from the back of the hip, and answereth the Bevel standing on the Raising Piece; but if you would have the Bevel as it stands over the Diagonal Joyst, then count the Perpendicular on the loose piece, and make it a Parallel in the hips length on one leg, and the half Diagonal on the other leg.

Now by the Diagonal is meant a line from one corner of a true square piece to its opposite corner; and to find the length of this line, do thus, Set the Rule to a right Angle, by making 90 degrees on the line of Chords a Parallel in 15. and 15, then the Rule thus standing at right Angles, count the width of your Frame on each leg, and take out the Parallel distance with the loose piece, and on the loose piece will be the Diagonal required.

To set the Rule to the mould or back of the hip, do thus: First find the neareſt distance from one corner of the Frame to the hip Rafter set up in its place on the opposite corner; which to do, first count the hips length

length on the looſe piece, and make it a Parallel in the width, counted on one leg, and the hips length counted on the other leg; then the Rule thus ſtanding with the looſe piece, take the neareſt diſtance between the width of the Frame and the other leg, I mean, ſet the Joggle on the looſe piece to the width of the Frame, and move it to and fro, till you find by the looſe piece what is the neareſt diſtance of the other leg; which note.

Then count the half Diagonal on the looſe piece, and make a Parallel in half the neareſt diſtance laſt found; then is the Rule ſet to the Mould, or outer-Angle of the back of the hip.

To find the length of a Coller Beam, or any heighth from the Floor-er: Firſt, ſet the Rule that one leg may repreſent the Floors, and the other the Rafter, which is done by making the Perpendicular a Parallel in the Rafters length and halfwidth, then count the heighth that you would have your Coller Beam from the Floor on the looſe piece, then

ſlide the Joggle along on that leg which repreſenteth the Floor, till the number that ſheweth the heighth of the Coller Beam will but juſt reach the other leg that repreſenteth the Rafters; at the neareſt diſtance, you can then note that on the Rafter; then having done this, count the width of the Frame on the looſe Piece, and make it a Paralliel in the Rafters length, and the Rule thus ſtanding, take out the Parallel between the numbers laſt noted on the Rafter leg, and that Parallel on the looſe piece will ſhew the length of the Coller Beam required. Alſo note, when the Rule ſtandeth, that one leg repreſenteth the Rafter, and the other the Floor, as was ſhewn, but now then it ſtandeth to the Bevel, to cut the Joint of the ſaid Coller Beam.

Note, that the length of the Coller Beam may be found by the *Sliding Rule*, ſaying,

As the whole Perpendicular is to the whole width, ſo is a part of the Perpendicular to a part of the width.

Alſo

Alſo note, that in ſquare Frames and true Pitch, the Rafters length perpendicular, and hips length may be found by the ſaid *Sliding Rule* on lines of proportion, whoſe Analogy is. And,

As 10 to 7.5, ſo is the width to the Rafters length, or the contrary.

Again, as 10 to 9, ſo is the width to the hips length.

Again, as 10 to 5.59, ſo is the width to the Perpendicular.

Again, as 10 to 14.14, ſo is the width to the Diagonal.

Again, as 10 to 8.312, ſo is the width to the neareſt Diſtance.

Note, that if you ſuppoſe your Frame to be 20 foot wide, then if you work by the Scale of Scales, or Line of Proportion, you will find your Anſwer, if you err not, to be as in this Table.

A Table of Lengths in Square Frames.

	Foot.	Parts.
The Width	20	00
The Hips or Steepers	18	00

	foot.	parts.
The Perpendicular	11	18
The Rafters Lengths	15	00
Diagonal	28	281
Neareſt Diſtance	16	624
Length of the Coller Beam at 5.59 foot from the Floor	10	00

This is to be underſtood of ſquare Frames, and true Pitch; note, by true Pitch is meant three quarter Pitch, or 9 inches to the foot, as ſome call it; and by ſome it is called *London* Pitch.

Of Bevelling Frames.

To find the Rafters length in Bevelling Frames, Set the Scale to a right Angle, as before, then count the quantity of the Bevelling on one leg, and the ſquare width on the other leg, then take out the Parallel of theſe two Numbers, and you will have the length of the Bevel end on the looſe piece; then for the Rafters, do thus: The Rule thus ſtanding at right Angles, count the half length of the Bevel end on one leg, and the Perpendicular on the other

ther end, then take out that Parallel, and on the looſe piece you have the length of the Rafters to ſtand over the Bevel end.

The Bevel at head and foot are found as in ſquare Frames, thus, for the foot count the Perpendicular on the looſe piece, and make it a Parallel in the Rafters length, and half width, and for the top count the half width on the looſe piece, and make it a Parallel in the Perpendicular and Rafters length; but this Beave is it that Jointeth to the Crown Poſt, or Kings Piece, and not the other Rafter: But if you would have the Bevel fitting the other Rafter, then inſtead of the half width, count the whole width on the looſe piece, and make it a Parallel in the Rafters length on both legs. Underſtand the like of ſteepers and hips; and here by the way, let me tell you that know it not, that the Bevel made by making the half width a Parallel in the hips length on one leg, and the Rafters length on the other leg, is the Bevel of the top of the hips fitting middle piece, or framing into a Theſt-

er.

er. Alſo note, that this Bevel cuts the foot of the Jacks on that ſide that ſtandeth next the ſteeper; the other is made by the Perpendicular, a Parallel in the half width, and Rafters length.

Thus much by the way, now to my Bevel Frame to find the Hips length.

To find the Hips length.

Set the Rule to the Angle of the Frame at each corner; then one being more than a Square, or 90 Degrees, and the other leſs than the Parallel from the half length of the Bevel end, counted on each leg, ſhall be the half Diagonal line, fit for each corner; then with the half Diagonal and whole Perpendicular find the Hips length, as in ſquare Frames.

Neareſt Diſtance, and Hips Backs.

To find the neareſt Diſtance, do as before to ſet the Rule, make the length of the neareſt Diſtance, and length of the Bevel end make a Parallel; but when you have taken the neareſt

neareſt diſtance, you muſt add half the number of feet and inches of the Bevelling to the neareſt diſtance over in one, or ſhorteſt hip, and take ſo much leſs

Then the neareſt diſtance over in the other or longeſt hip, which always hath the leaſt Angle on the outſide of the hip, the ſhorteſt Diagonal line belongeth to the longeſt hip, then count the Diagonal on the looſe piece, and make it a Parallel in each neareſt diſtance, ſets the Rule to the Mould or Angle on the back of each Hip one after another.

Thus much for Roofs; the exact length of Braces and Stain-ſtrings may be found by the ſaid Scales, and their Joints cut.

For Braces.

Set the Rule to a right Angle, then count on one leg the diſtance that the Brace is to ſtand from the Angle at foot, then count on the other leg how much the Brace is from the Angle in heighth, then will the looſe piece take that Parallel diſtance from leg to leg, and on the looſe piece

piece will be the length of the Brace required.

To cut the Joints at foot of the Brace.

Count the heighth of the Brace on the looſe piece, and make it a Parallel in the length of the Brace and the bottom-ſide, then ſtands the Rule to cut the Joint at the foot of the Brace to cut the Joint at the top.

Count the diſtance from the Angle at the bottom on the looſe piece, make it a Parallel in the other-ſide and the Brace lengths, then ſtands the Rule to cut the Joint at the top.

By this Rule you may alſo find the length of a Ladder that ſhall reach ſo high, and ſtand ſo far out at foot: Work as you did before in finding the Braces length, and you will have your deſire.

Of Strings for Stairs.

Set the Rule to right Angles, as before, then count the going on one leg, and the riſing on the other leg; and that Paralel diſtance will be the length of the ſtrings deſired.

Note,

Note, the Bevel at each end for the Joints, is found after the ſame manner as was the Braces.

To divide a Circle into any number of Parts.

Note, that every Circle is ſuppoſed to be divided into 360 equal parts, called degrees: Therefore divide 360 by that number you deſire to have your Circle divided into, then count the Quotient on the line of Chords on the looſe piece, and make it a Paralel in 15 and 15.

Then take the Semi-Diameter, and meaſure it from the middle of the Revet in the head of the Rule, then that Parallel extant will divide the Circle into the Numbers of parts required.

Example.

Suppoſe I were to divide a Circle into 3 equal parts, then I divide 360 by 3, the Quotient will be 120.

Then I ſeek 120 on the line of Chords, and make it a Parallel in 15 and 15. Then ſuppoſe the length of my Semi-Diameter were juſt ſo long,

as

as from the head of the Rule to 10 on the Scale of Scales, then that Parallel distance taken out with the loose piece will divide the Circle into 3 equal parts, as was required.

Note, these Scales are very commodious for Surveying of Land, and if the Rule were fitted to a Staff, to set up in a field, and Sights prefixed to the said Rule, as it may be very conveniently done, would be an Instrument not inferior to any other for that purpose of Surveying; all which with the Use and Application thereof to the said Art of Surveying, I will really and truly declare to any one that shall requeſt it of me; but it being a Treatise too long here fully to explain, therefore I shall omit it at present: But if these things finds acceptance, I will perhaps be more large in each particular, and then give a full discovery both of Surveying and Gauging, of which two I have here been very short; and my reason is, because I have not room nor time to discover it as yet, it not being my present design.

Having

Having thus far explained the Rule with the Uſe thereof, namely the Sliding Part, and the Scale of Scales that is placed between. I now come to explain the Scales on the other leg, and ſame ſide with the Sliding Part.

And firſt, I will tell you what their Uſe is, that you may the better conceive of them: Where note, that what hath been ſaid of the Scale of Scales in finding the length of Rafters, Hips, Perpendiculars, and Diagonal in ſquare or bevel Frames, and at all Pitches by Operation; ſo theſe lines will perform the ſame by inſpection; but note, I mean in ſquare Frames and true Pitch, and no other.

Note, that (*w*) ſtands for width, (*r*) for Rafters, *h*) for Hips or Steepers; and theſe Letters are placed on the left hand end near the Joint, and their reſpective lines are extended to the middle of the Rule, where the line (*w*) terminates in 20, and the line (*r*) terminates in 15, and (*h*) ends in 18. Their Uſe is thus,

The width of a Frame given, if you deſire to know the length of the Principal

cipal Rafter, or Hip, then ſeek for the width in the line (*w*), and juſt againſt it in the line (*r*, is the Rafters length, and on (*h*) is the Hips length required to the width propoſed in a ſquare Frame and true Pitch.

Example.

Suppoſe the width were 10 foot, then I ſeek 10 in the line (*w*), and againſt it in (*r*) I find 7 foot 6 inches the Rafters length, and in (*h*) I find 9, the Hips or Steepers length required.

Then for the Perpendicular and Diagonal, they are placed on the other part of the ſame leg, beginning in the middle, and extended to the end of the Rib, and are marked with (*p*) for Perpendicular, and (*d*) for Diagonal, and Letters are placed at the head of the lines near the middle of the Rule: And note, (*p*) terminates in 11.18, and (*d*) in 28.281. Alſo note, that over them is the line (*w*) again repeated, and terminates in 20, as before; ſo the uſe of this is the ſame with the former, ſeeking the width in (*w*), then againſt

againſt it on (*p*) is the Perpendicular, and on (*d*) is the Diagonal required to the width propoſed: As in the former Example, at 10 foot wide, ſeeking 10 in the line (*m*, then in the line (*p*) I find 5 foot 8 inches, and about half a quarter, the Perpendicular required; and on the line (*d*) is 14 foot 3 inches and about a quarter and half quarter.

Further note, that every great Diviſion repreſenteth a foot, and to it is placed the Figure, ſignifying ſo many foot, and each foot is again divided into half and quarter; ſo that each little Diviſion ſignifyeth 3 inches. Becauſe of the ſhortneſs of the Scale, I ſhall not divide them any more, let the reſt be diſtinguiſh'd by Scheme. But if your width ſhould exceed 20 foot, then ſcale 1 at the beginning of the lines 2, and ſo by doubling every Figure in every Scale, you will have a Scale for each particular to 40 foot in width.

Note, that although moſt times the width is given, ſet ſome times the Perpendicular Rafters length, or Diagonal, may be given; then it is

but

cipal Rafter, or Hip, then ſeek for the width in the line (*w*), and juſt againſt it in the line (*r*), is the Rafters length, and on (*b*) is the Hips length required to the width propoſed in a ſquare Frame and true Pitch.

Example.

Suppoſe the width were 10 foot, then I ſeek 10 in the line (*w*), and againſt it in (*r*) I find 7 foot 6 inches the Rafters length, and in (*b*) I find 9, the Hips or Steepers length required.

Then for the Perpendicular and Diagonal, they are placed on the other part of the ſame leg, beginning in the middle, and extended to the end of the Rib, and are marked with (*p*) for Perpendicular, and (*d*) for Diagonal, and Letters are placed at the head of the lines near the middle of the Rule: And note, (*p*) terminates in 11.18, and (*d*) in 28.281. Alſo note, that over them is the line (*w*) again repeated, and terminates in 20, as before; ſo the uſe of this is the ſame with the former, ſeeking the width in (*w*), then againſt

againſt it on (*p*) is the Perpendicular, and on (*d*) is the Diagonal required to the width propoſed: As in the former Example, at 10 foot wide, ſeeking 10 in the line (*w*, then in the line (*p*) I find 5 foot 8 inches, and about half a quarter, the Perpendicular required; and on the line (*d*) is 14 foot 3 inches and about a quarter and half quarter.

Further note, that every great Diviſion repreſenteth a foot, and to it is placed the Figure, ſignifying ſo many foot, and each foot is again divided into half and quarter; ſo that each little Diviſion ſignifyeth 3 inches. Becauſe of the ſhortneſs of the Scale, I ſhall not divide them any more, let the reſt be diſtinguiſh'd by Scheme. But if your width ſhould exceed 20 foot, then ſcale 1 at the beginning of the lines *r*, and ſo by doubling every Figure in every Scale, you will have a Scale for each particular to 40 foot in width.

Note, that although moſt times the width is given, ſet ſome times the Perpendicular Rafters length, or Diagonal, may be given; then it is

but

but to look the given part in its particular Scale, and againſt it in each other particular Scale, is the Anſwer.

On the other ſide of the Rule, is placed the line of common inches, whoſe uſe is known to every one that practiſeth a Rule; therefore of that I ſhall ſay no more than juſt by the ſaid line of inches, on the ſame ſide, is a line dividing the foot into 100 equal parts, called Decimals, and is to take dimenſions with as the former; alſo, if the dimenſions are given in inches, then by this Line you may by inſpection reduct it into Decimals; ſo that thereby it will be the more agreeable for operation either by Pen or Inſtrument, as hath been ſhewn before.

Example.

Suppoſe my dimenſions were 5 foot 3 Inches and a quarter broad, and 13 Foot 9 Inches and 3 quarters long.

Now to multiply 5 f. 3 in. $\frac{1}{4}$ by 13 Foot, 9 in. $\frac{3}{4}$ is ſomething troubleſom, therefore by the Line I find that againſt 3 in. $\frac{1}{4}$ is .271, for the Decimal of 3 in. $\frac{1}{4}$, and for the Decimal

cimal of 9 in. $\frac{3}{4}$ is .812, therefore I multiply 13.812 by 5.271, the product will be 72.8; or if by the ſliding Rule you ſet 1 on (*b*) to 5.271 on (*a*), then againſt 13.812 on (*b*) will ſtand 72 8 on (*a*), the product as before: Alſo by theſe Lines you may verily find the Decimal of any thing elſe, obſerving that 25 is equal to 3 Inches, or a quarter of a Foot, and 5 or 50 equal with 6 Inches or half a Foot, and 75 is 9 Inches or three quarters of a Foot, and ſo by conſequence, theſe numbers are the Decimals of $\frac{1}{4}$, $\frac{1}{2}$ or $\frac{3}{4}$ of any thing elſe.

Example.

Suppoſe my integer were 20 f. then .25 will ſignify 5 f. .5 10 and .75 15 f. being $\frac{1}{4}$ $\frac{1}{2}$ and $\frac{3}{4}$ of a pound or 20 ſhillings.

Alſo by theſe Lines of Inches and Decimals, having the price given of a looſe or Square, what doth 1 Foot come to then, look the price on the Decimal Line, then againſt it on the Line of Inches is the price of 1.

Example.

At 50 ſhillings a 100 or Square, what cometh 1 foot to? Then againſt

50

50 on Decimals is 6, signifying 6 pence for 1.

Note that the other Leg is divided into 112 parts, signifying the great hundred, and is to be used as the former, to know at such a Rate for the great hundred, what cometh one pound to, then seek, the price in shillings on that Line, and against it is the Answer.

Hitherto of the description of the Rule with the Lines thereon described; and also applying them to their particular uses in the taking dimensions, and also computing, and casting up the contents of any thing, whose dimensions are given, with other things, necessary to be known by every handicraft Artificer.

I shall now show in some measure, what quantity of Materials will be sufficient to do such a piece of work; and here I shall not trouble my self nor you with the price of Materials, nor Workmanship, it being a thing so different in several places, that in one place the same work may be worth twice as much in other places; but if I show you a way by which you

you may give a near gueſs what quantity of Materials will do thy work; thou mayſt by what hath been ſaid before, eaſily compute the value or Charge.

Firſt, I ſhall begin with Bricks and Bricklayers work.

Of the Size of Bricks.

Bricks by the Statute, ought to be

in length	9 Inches.
in breadth	4 $\frac{1}{2}$
in thickneſs	2 $\frac{1}{4}$

But here note, that in burning, they will ſhrink, tho' the Moulds are of this ſize, but there are ſeveral other ſizes, but the Law taketh no cogniſance of any other: And a Brick of this ſize well burnt and dry, will weigh about 6 *l.* $\frac{1}{2}$, ſo that 1000 will weigh about 6500 *l.* weight.

And of theſe Bricks, there are generally allowed for every Rod 4500 of Bricks; what a Rod of Brick work is, and how to meaſure it, I have ſhewn before; but becauſe I would compoſe a great deal in a little room, obſerve the following Method.

4500 Bricks will make a Rood of work in a Wall; 32 will lay a yard of

of Paving; but Paving is generally done with ſquare Bricks, commonly called paving Tiles, being made, ſome 6 Inches ſquare, ſome 8, ſome 9, and ſome 10; therefore of 6 Inches Tiles 36 will pave a Yard; of 8 Inches 20 will pave near a Yard; of 9 Inches 16 will pave a Yard; of 10 Inches 13 will pave a Yard or better; note, it is generally above 3 ½ Buſhels of Lime, and half a load of Sand for the laying 1000 of Bricks.

Of Tiling.

Tiles ought to be 10 ½ Inches in length and 6 in breadth.

Ridge Tiles are about 14 Inches long; a Tile will weigh about 2 ½ *l.* ſo that 1000 will weigh about 25 *C.* which is a moderate Load.

Tiling is generally counted by the Square, and 7 or 800 are allowed for to lay one ſquare of Tiling; but this is as they are gauged. but

Note that ſo many Laths as are in two Foot, ſo many Tiles generally go in a Square of Tiling; and about four Buſhels of Lime and ¾ load of Sand, and 70 Laths, and 350 Mouls to every ſquare of Tiling.

Of

Of Playſtering.

This is generally done by the yard ſquare, allowing 6 Yards for every 100 of Laths, and 500 of Nails to 110 of Laths; and about 10 Yards of Playſtering to every Load of Lome.

Of Carpenters work.

It may be allowed that one Load of Timber will frame 2 ſquares of work, but this is according to the ſcantling or ſtoutneſs of the Building.

Of Flooring.

A 100 Foot of Board for one ſquare, but here muſt be allowance for waſte, according as your Boards are in goodneſs, and fit your lengths.

For Nails you may allow 200 for a ſquare.

Of Doors.

Theſe are various, yet a fair ſingle Door, at 6 Foot high, and three Foot wide, will take up about 25 Foot of Board, and 70 Nails.

Of Stairs.

Theſe are various, yet Stairs of 4 Foot wide, will take up about 3 ½ or 4 Foot of Board, and 14 Nails each ſtep; winding ſtairs the ſame length, will be thereabouts alſo.

Smiths work is generally done by

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Smiths work is generally done by

the Pound or Pence, and at ſeveral rates, therefore I ſhall make no allowance for that any other ways.

Glaſiers Work is the ſame, generally by the Foot at a certain price, but ſometimes more, ſometimes leſs. Painters and Joyners work by the Yard. and in taking their dimenſions, they cauſe a Line to paſs into every crook and ſwelling of the work.

But in meaſuring of Palaſades, they ſometimes meaſure only one ſide, letting the other go for the vacancy.

And Joyners tho' they crooch the Line in the height, yet in the length they take it on a ſtreight.

Note that for Lead, about 8 or 9 pound of ſheet Lead will cover a foot ſquare when new, but it will waſte in lying, ſo that a Foot will weigh not above 6 or 7 pound.

Note one thing more, that in digging of Vaults or Cellars, that 3 Foot or a cubicle Yard is above a load of Earth, ſo that finding how many cubicle Yards you have in your Vault, or either you may know how many Loads of Earth you have to caſt up or carry away.

Of

Of the proportion of Iron, Braſs, and Lead. Where

Note that an Iron Globe or ſhot, whoſe diamater is 8 Inches, will weigh 72 *l.* and a Braſs Globe or ſhot of the ſame diameter, *viz.* 8 Inches, will weigh 80 pound and 12 Ounces. And a Lead ſhot of the ſame diameter, will weigh 103 pound and a half, ſo that the proportion betweeu Iron and Braſs, is as 72 to 80.75, and Iron and Lead is as 72 to 103.5, and Braſs and Lead is as 80.75 to 103.5. The preceding Lines being well premiſed, I hope you will be moderately qualifyed for the giving an eſtimate Account of moſt things that may haply be of neceſſary concern in any of your Mechanical Affairs; but for as much as in dealing, it is of great concern to know the day of the Month, and ſeveral other things appertaining thereto; I ſhall therefore give you ſome ſhort memorable Rules for the finding the ſame by your Head only, or at leaſt by viewing this ſmall Table.

The Table or ALMANACK.

Sun. let.	B.	C.	D.	A.	G.	F.	E.
W. D.	S.	m	t.	w	t.	f.	ſa.
L. Year.	96	80	92	40	88	700	84
Epact	6	18	22	4	7	20	23
Months	1/9	6	3/11	8	5/2	7/10	4/12
	1	2	3	4	5	6	7
Days.	8	9	10	11	12	13	14
	15	16	17	18	19	20	21
	22	23	24	25	26	27	28
	29	30	31				

The Uſe of the Table or Almanack.

THIS Almanack hath nine or ten ranks of Figures and Letters, whoſe Names are expreſſed at the left hand, *viz.* (W. d.) for Weeks days. (Sund. let.) for Dominical or Sunday Letter. (L. Year.) for Leap year; and (Epact.) for the Epacts in thoſe Years; Months.

Months. For the 12 Months in numeral Figures, according to the Old *Roman* Account, *viz. March* the firſt, and ſo on to *February*, being the 12*th.* Month; and laſtly, 7 ranks for 7 times 7 days, called Keys, and the uſe is thus,

To find out what Week-day the firſt of March, *or firſt Month falls on.*

If it be Leap-year, and expreſſed in the Almanack, then the Week-day letter right over it, anſwereth the Queſtion; as in the Year 1680 the (m) for *Monday* right over it, ſheweth that the firſt day of *March* was *Monday*, iu the year 1680. But if the Year propounded be not Leap-year, then ſeek for the laſt Leap-year next before the Year propounded, and about ſucceſſively as the days proceed, and you have the day required. *Example.*

In 1683 to find on what Week-day the firſt of *March* will be, the Leap-year next before 1683, is the y. 1680, and then the Almanack ſhewed that the firſt of *March* was *Monday*; in 1681 it was *Tueſday*; in 1682 it was *Wedneſday*; and in 1683 it was

Thurſday; the anſwer to the queſtion, and the next Leap-year, *viz.* 1684 which is expreſſed in the Almanack, it will be *Saturday*, as the Letters (*ſa*) over 1684 ſheweth.

2*dly*. Having the day of the Week the firſt of *March* is on, to find the Week-day of any day of any Month of that Year; And the contrary.

Seek the Month amongſt the rank of Months, calling *March* the firſt, and the reſt in order. Thus,

March 1. *April* 2. *May* 3. *June* 4. *July* 5. *Auguſt* 6. *September* 7. *October* 8. *November* 9. *December* 10. *January* 11. and *February* 12.

I ſay, ſeek the Month among the rank of Months, then all the days right under, are the ſame days of the Week as was the firſt of *March*, and ſo counting orderly from the next neareſt day you have your deſire.

Example.

On the 25 of *Auguſt* 1683, what Week-day is it?

By the firſt Rule I find the firſt of *March* in 1683 to be *Thurſday*, then *Auguſt* being the 6*th*. Month from *March*; ſeek 6 in the rank of Months, then

then all the days right under, *viz.* the 2, 9, 16, 23, and 30. are all *Thurſdays*, then the 23 being next or neareſt to 25; if 25 be *Thurſday* the 24 is *Friday*, and the 25 is *Saturday*; the day required, and ſo for any other.

On the contrary, knowing the day of the Week, to find the day of the Month.

Example.

In *October* 1683, on a *Wedneſday* near the beginning, what day of the Month is it? Seek 8, for *October* being the 8 Month from *March*, and all the days right under being *Thurſday*, and the day named *Wedneſday*, and near the beginning of the Month, muſt needs be the third or tenth required.

3*dly*. To find the *Epact* any Year for 28 Years.

In every Leap-year, you have it expreſt in the Almanack right under it; for every Year between, add 11 to what it was in the Leap year, and the ſum if under 30, or the remainder 30 being ſubſtracted, is the Epact for that Year. *Example.*

In 1685 what is the Epact?

Look in the Line of Leap-years for the laſt Leap-year before the preſent year, propounded, which is 1684, the number 23 right under it was Epact, then the Year propounded, being 1685, one Year after it, add 11 to 23, it maketh 34, from which take 30, remaineth 4 for the Epact 1685; if it be two Years after the Leap-year, add 22; if 3 years, add 33, and the remainder 30 being ſubſtracted, is the Epact for the preſent Year propounded.

4*thly*. Having the Epact and day of the

Month to find the Moons Age. Add to the Epact the Month, and Day of the Month, calling *March* 1. *April* 2. *May* 3. *June* 4. &c. The Sum if under 30, is the Moon's Age to a day, but if the sum be above 30, and the Month have 31 days, then subſtract 30, but if the Month have but 30 days, then subſtract but 29, and the remainder is the Moons Age to a day; to know how many days every month hath, remember this Verſe, and ſay,

30 *Days hath* September,
April, June, *and* November;
All the reſt have 30 *and one,*
Except it be February *alone.*

Which if it be Leap-year, hath 29, otherwiſe but 28. *Example of the Moons Age.*

On the 30th of *October*, 1683. what is the Moons Age?

The Epact as found by the laſt Rule, for the Year 1683, is 12, to which add 8 for the Month is 20; then to this add 30, for the Day of the Month, makes 50. Now becauſe *October* hath 31 Days, therefore from 50 I ſubſtract 30, and there remaineth 20 for the Moons Age on *October* 30, 1683.

5thly. Having the Moons Age, to find her coming to the South, multiply the Moons Age by 4, and divide by 5, the quotient is the time of her Southing, or this may be done by the Sliding-rule, thus; ſet 4 on (*b*) to 5 on (*a*), then ſeek the Moons Age on (*a*) and againſt it on (*b*), will be the Hour, and decimal parts of an Hour of the Moons Southing. *Example.*

The Moons Age being 9 days Old; 9 times 4 is 36, which divided by 5, quotes $7\frac{1}{5}$, or by

the

the Rule, when 4 and 5 are ſet even; then againſt 9 is 7.2 which is 7 a Clock, and 10 Minutes; then 3 Hours after, at New and Full Moon, it is High-Water.

But at the quarters between it is found to be ſooner by an Hour, *viz.* at 2 Hours after the Moons coming to the South, and gradually betwixt them.

6thly. To find the Hour of the Night by the ſhadow cauſed by the Moon on a Sun-Dyal at any time of her Age, by the 5th. Rule, juſt before, you may find the Moons Southing, then the Complement thereof to 12 ſubſtracted in the Increaſe of the Moon, or added in the decreaſe of the Moon, to what the Moon ſheweth on the Sun-Dyal, is the near time of the Night.

Example.

At 10 days Old the Moon cometh to the South at 8 of the Clock at Night, whoſe complement to 12 is 4 hours; then ſuppoſe the Moon ſheweth 11 a Clock, 4 Hours being ſubſtracted, becauſe the Moon is increaſing, maketh 7 a Clock; but if the Moon had been 20 days Old, and ſhewed 9, then adding 4 becauſe the Moon decreaſeth, maketh 1 a Clock, the near Hour of the Morning.

To find the Golden Number.

Add 1 to the Year propounded and divided by 19 what remains is the Golden Number. Example in 1693, add 1 makes 1694, divided by 19, there remains 3, the Golden Number.

Having found the Golden Number, as was laſt ſhewn; and the Sunday Letter as hath been ſhewn before; then by the following Table, you may find when *Eaſter* will

be for ever, and so by consequence, the rest of the Moveable Feasts.

G. n.	d. l.	Easter.	g. n.	d. l.	Easter.
16		March. 22	6	b	10 Apr.
5	d			c	11
	e	23	14	d	12
13	f	24	3	e	13
2	g	25		f	14
	a	26	11	g	15
10	b	27		a	16
	c	28	19	b	17
18	d	29	8	c	18
7	e	30		d	19
	f	31		e	20
15	g	1 Apr.		f	21
4	a	2		g	22
	b	3		a	23
12	c	4		b	24
				c	25
1	d	5			
	e	6			
9	f.	7			
	g	8			
17	a	9			

The

The Use of the Table.

Having the Golden Number and Sunday letters as before, then seek the Golden Number in the first or fourth Column under the Title (g n), then having found the Golden Number for the Year proposed; then in the next Column find the Sunday Letter for that Year next after it.

Example.

In the Year 1693, the Golden Number is 3, and the Sunday Letter *a*, then I seek the Golden Number, *viz.* 3 and I find it in the 4th. Column, then I guide my Eye down among the Sun. let. within the next Column, till I come to *a* the Sunday Letter, then right over against *a* in the column noted *Easter*; I find 16, and a little above is written *April*, which telleth me that in 1693, *Easter* is on the 16 day of *April*; then for 94 the *g. n.* is 4 Sun. Let. *g*. I find 4 in the first column, and against *g* next following is 8, and *April* above, so that in 94, *Easter* will be the 8 day of *April*; and in 95, 'twill be the 24 of *March*, and 96 *April* 12. then the other moveable Feasts are thus found.

Advent Sunday is always the neareſt Sunday to St. *Andrew*, whether before, or after. And St. *Andrew* is always the 30 or the laſt day of *November*.

Septuageſima Sunday is 9 Weeks before *Easter*.
Sexageſima Sunday is 8 weeks before *Easter*.
Quinquageſima Sund. is 7 weeks before *Easter*.
Quadrageſima Sund. is 6 weeks before *Easter*
Rogation Sunday is 5 Weeks after *Easter*.
Aſcenſion Day is 40 days after *Easter*.

Whit-

Whit-Sunday is 7 Weeks after *Easter*
Trinity Sunday is 8 weeks after *Easter*.
Shrove Sunday and *Quinquagesima* is all one, so that the *Tuesday* following is *Shrove-Tuesday*,
These are called moveable Feasts, the fixed are as follow.

An Account of fixed Feasts and Quarter Days.

Circumcision or New Years day, *Jan.* 1*st*. day,
Epiphany or Twelfth Day, *January* 6*th*. day.
Conversion of St. *Paul*, *January* 25*th*. day.
Purification of the Virgin *Mary*, or *Candlemass-day*. } Feb. 2*d*. day.
St. *Matthias* —— *February* 24*th*
Annunc. of the Virg. *Mary*, or *Lady-day*, —— } *March* 25*th*
St. *Mark* —— *April* 25*th*
Philip and *James*, or *May-day*, *May* 1*st*
St. *Barnaby* —— *June* 11*th*
St. *John* the Baptist —— *June* 24*th*
St. *Peter* and St. *Paul* —— *June* 29*th*
St. *John's day* —— *July* 25*th*
St. *Bartholomew* —— *August* 24*th*
St. *Matthew* —— *September* 21*st*
St. *Michael* or *Michaelmas-day*, *Septemb* 29*th*
St. *Luke* the *Evangelist* *October* 18*th*.
St. *Simon* and St. *Jude* —— *October* 28*th*
All Saints —— *Novemb* 1*st*
St. *Andrew* —— *Novemb* 30*th*
St. *Thomas* —— *Decemb* 21*st*
Christmass day —— *Decemb* 25*th*

Of Weights and Measures used in England.

THE most common Weights used in *England*, are *Troy* and *Averdupois*, by the first is weighed Wheat, Bread, Gold, Silver, *&c.* which *Troy* weight contains in every pound 12 ounces, every ounce 20 penny weights, every penny weight 24 grains. By

By the second, and more common weight of *Averdupois*, is weighed all kind of Grocery Wares, Physical Drugs, and all gross Wares, as Rosin, Pitch, Hemp, &c. and all Iron, Copper, Tin, and other Mettals; these Weights have 16 ounces to the pound, and is divided into Grains, Scruples, Drams, and Ounces, so that 1 pound *Averdupois* contains 16 ounces, 128 drams, 384 Scruples, and 768 Grains.

Of the Measures of Ale, Beer, and Wine, I have shewn before, therefore shall say nothing of it here; only note, that Oyle and Hony are measured by the same measure.

Of Corn and dry Grain.

CORn is measur'd by the Pint, Quart, Pottle, Gallon, Peck, Tovet or half Bushel, Strick, Cornook, Quarter and Last; now a Last is 10 Quarters, 20 Cornooks, 40 Stricks, 80 Bushels, 160 Tovets or half Bushels, 320 Pecks, 640 Gallons, 1280 Pottles, 2560 Quarts, 5120 Pints.

Of Iron, Lead, Tin, Copper, and Butter.

IRon is counted by the pound, hundred, and tun, of which a Tun is 2000 pound, Lead is reckon'd by the pound, hundred, fodder; a fodder is 19 hundred and a half at 122 to the hundred; Tin, Copper, and Butter, hath 112 pounds to the hundred. *Of Fish.*

LIng, Cod, or Habberdine, have 124 to the hundred, Stock-fish 120 to the hundred, Herrings are counted by the hundreds, thousands, and Lasts; a Last is 10000, and in every thousand 1200, and every hundred 120 to the hundred.

Of Paper and Parchment.

PAper is counted by the Sheet, Quire, Ream, and Bale, whereof one Bale is 10 Ream, one

one Ream 20 Quire, and one Quire 25 Sheets. Parchment is counted by the Skin, Dozen and Role, a Role is 5 dozen, a dozen is 12 Skins.

Of Wool.

WOol is counted by the Laſt, Sack, Wey, Tod, Stone, Clare, and Pound; whereof 7 pound makes 1 Clare, 2 Clares 1 Stone, 2 Stones 1 Tod, 6 Tods 1 Wey, 2 Weys 1 Sack, 12 Sacks 1 Laſt.

Of Skins, Timber.

SKins are counted by the Sables, Montons, Mints, Jenits, Titches; Greys have four Skins; in the Timber, Cony, Kid, Lamb, Badge. and Cats have five ſcore to the hundred; Goat Skins are 50 to the Rip; and Tan'd Cat's Skins 12 to the dozen: Leather is numbered by the Hide, Dicker and Laſt; a Laſt is 20 Dickers, and a Dicker is 10 Hides.

How Mony is numbered in England.

THe leaſt piece of mony with us is a farthing, whereof 4 make a penny, 4 pence a groat; there are alſo 4 pence halt penny pieces, and 6 penny pieces, 9 penny pieces, 12 penny pieces, and 13 pence half penny pieces; and of this ſort there are alſo halfs and quarter pieces, and 3 penny, 2 penny, penny, and halt penny pieces; there are alſo 30 penny pieces, called Half Crowns, and whole or 5 *s.* pieces: and a Crown of Silver ought to weigh juſt an ounce *Averdupois.* There are alſo of gold *Guinea's* or half *Guinea's* formerly valu'd at 21 *s.* 6 *d.* but now they are valu'd at more, as 21 *s.* 9 *d.* or ſometimes 22 *s.*

Memorable Notes for counting of Time and Expence.

NOte, ſo many pence as is ſpent in one day, amounts to ſo many Pounds, ſo many Angels, ſo many Groats, and ſo many Pence in

in a year, taking in *Sundays* and all: but if you would count only the working days, then count only so many Pounds, so many Crowns, so many Shillings, and so many Pence, as the number of pence in one days Expence.

Again so many Shillings expended in a week, then twice the pounds, twice the crowns, and twice the shillings agreeth.

Again, so many shillings as a month doth make, then half the pounds, half the crowns, and half the shillings take.

Of Corn, and first of wheat.

NOte, that so many shillings as one Bushel doth yield, makes twice the pounds for a load, or 40 Bushels fill'd, and the contrary, having the price of a load: or again, so many shillings as one Bushel doth make, so many pence and half pence for a Gallon take, and the contrary. This answereth all things counted by the Bushel and Gallon: But for Oats or others, that are counted, to Quarters or 80 Bushels to the Load, say so many shillings whereunto one Bushel doth amount, then four times the Pounds I count.

Directions for writing Bonds, Bills, Releases, &c.

A Bond, with a condition from one to one.

NOverint Universi per præsentes, me Gulielmum Hadher de Rickling, *in comitatu* Essexiæ, *generosum teneri & firmiter obligari* Thomæ Batterſey, *de Jason in comitatu* Cantabrigiæ, Armigero, *in centum libris bonæ & legalis monetæ Angliæ solvend. eidem* Thomæ Batterſey, *aut suo certo Attornato Executoribus vel Administratoribus suis. Ad quam quidem solutionem*

untn bene & fideliter faciendam obligo me Executores & Administratores meos firmiter per presentes sigillo meo. sigillat. dat. oct. die Januarii, *Annoq; Domini* 1693, *Anno Regni Domini & Dom.* Gulielmi *&* Mariæ, *dei gratia* Angliæ, Scotiæ, Franciæ *&* Hiberniæ, *Regis & Reginæ, fidei defensorum,* &c. *sexto.*

THe Condition of this Obligation is such, That if the above bound *William Hadher*, his Heirs, Executors, Administrators, or Assigns, do and shall well and truly pay or cause to be pay'd unto the above-named *Thomas Batterſey*, his Executors, Administrators, or Assigns, the full sum of Fifty Pounds of lawful mony of *England*, at one entire payment, on the 8*th*. day of *July* next ensuing the date hereof, without fraud or delay; then this present Obligation to be void, and of no effect, or else to remain in full force and virtue.

A plain Bill of Debt.

BE it known unto all men by these presents, That I (*A. B.*) of, *&c.* do owe and am indebted unto (*C. D.*) of, *&c.* in the sum of, *&c.* of lawful mony of *England*, to be paid unto the said (*C. D.*) his Executors, Administrators or Assigns, on the, *&c.* next ensuing the date hereof, to the which payment well and truly to be made, I bind me, my Heirs, Executors and Administrators, firmly by these presents. In witness whereof I do hereunto set my Hand and Seal this, *&c.* day of, *&c. Anno Dom.* &c.

Sealed and deliverd in the presence, of *A. B.*

L. M.

O. P.

A General Release.

KNow all men by these presents, That I (*J. K.*) of —— have remised, released, and quit claimed, and by these presents do for me, my Executors, Administrators, and Assigns, remise, release, and for ever quit claim unto (*C. D.*) of —— his Executors, Administrators, and Assigns, all and all manner of Actions and Suits, Cause and Causes of Actions and Suits, Bills, Bonds, Writings, and Accompts, Debts, Duties, Reckonings, sum and sums of mony, Controversies, Judgments, Executions, and Demands whatsoever, which the said (*I. K.*) ever had, or which my Executors, Administrators, or Assigns, or any of us in time to come, can or may have to, for, or against the said (*C. D.*) his Executors, Administrators, and Assigns, for or by reason of any matter, cause or thing whatsoever, from the beginning of the world to this present day of ——

A Bill of Sale.

KNow all men by these presents, That I (*A B.*) of — for and in consideration of the sum —— of lawful mony of *England* to me in hand paid by (*I.S.*) of —— at, and before the ensealing and delivering these presents, wherewith I confess my self fully satisfied, contented, and paid, have bargained and sold, and by these presents do fully, clearly, and absolutely bargain and sell unto the said (*I. S.*) in plain and open market, to have and to hold the said *Here the Goods delivered are to be nominated.* —— to the said (*I. S.*) his Executors, Administrators, and Assigns, to his and their proper uses and behalfs for ever,

ever; and I the said (*A. B.*) my Executors, Administrators, and every of us, the said Goods unto the said (*I. S.*) his Executors, and Administrators, against all people shall and will warrant, acquit, and for ever defend by these presents, provided always, that if I the said (*A. B.*) my Heirs, Executors, Administrators, &c. or any of us, do well and truly pay, or cause to be paid unto the said (*I. S*) his Executors, Administrators, or Assigns, the full sum of —— at or in the —— without fraud or cozen, that then this present Bill, and the Bargain, and Sale of the said Goods shall be utterly void, and of no effect, or else to stand and abide in force and virtue.

The Condition of an Award.

THE Condition—— That if the within bounden (*W. D.*) his —— do for his and their parts and behalfs in all things, well and truly stand to, observe, perform, fulfill, and keep the Award, Arbitrement, Order, final End, Determination or Judgment of (*A. B.*) of—— and (*C. D.*) of —— Arbitrators, indifferently chosen, elected, and named, as well on the part and behalf of the said (*W. R.*) as on the part and behalf of the within named (*I. W.*) to arbitrate, award, order and judge, determine, and final end to make of, upon, touching and concerning all and every Action and Actions, Suits, Variances, Sum and Sums of mony, Claims and Demands whatsoever, had, moved, depending, or stirring, or having been, or now in being, in Question, Suit or Trouble between the said Parties, by reason or means of any manner of

of dealing, &c. between the said *P.* and I in any manner of ways, so as the said Award, Arbitrement, &c. of the said Arbitrators, of and upon the Premises, or any part thereof be made and put in writing under their Hands and Seals, ready to be delivered to the said Parties, on, or before, and next ensuing the date —— that then ——

The Form of an Award.

TO all Christian people to whom this present writing of Award, intended, shall come, (*G. M.*) of —— sendeth Greeting in our Lord God everlasting: Whereas divers Questions, Controversies, and Suits, have been had, moving and depending between (*P. P.*) of —— of the one party, and (*R. H.*) of —— of the other party, as well for, and concerning the interest and profits of the Rectory and Parsonage of —— as also for other Causes and Actions; for the appeasing wherof, either of the said Parties have elected and chosen me the said (*G. M.*) to be Arbitrator indifferently between them, and to that end have bound themselves either to other by Obligation in the sum of —— to stand to, and abide the Award, Arbitratement and Judgment of me the said (*G. M.*) touching the said premises now known, yet that I the said (*G. M.*) take upon me the charge of the said Award, and minding that a final end and agreement shall be had and continued from hence forth between the said Parties touching the Premises, do make and declare this my Award in manner and form following; that is to say, first, I award —— *Here the Conditions are to be mentioned what the said Arbitrator or Arbitrators have agreed on.*

A Letter of Attorny.

KNow all men by these presents, That I (*W. W.*) of—in the County of—Gent. having assigned, ordained, and made, and in my stead and place, by these presents, put and constituted my trusty and well-beloved friend (*S. G.*) of—in the County of— to be my true and lawful Attorny, for me and in my name, and to my use, to take, ask for, sue, levy, require, recover, and receive of (*L. P.*) of—in the County of—all and every such Debts and sums of mony which are now due unto me by any manner of ways or means whatsoever, giving and granting unto my said Attorny my whole power, strength, and authority, in and about the premises. And upon the Receipt of any such Debts or Sums of moneys aforesaid, Acquittances, or other Discharge for me, and in my name, to make Seal and Deliver; and all and every such act and acts, thing and things, device and devices whatsoever in Law, for the recovery of all or any such Debts or Sums of mony as aforesaid, for and in my name to do, execute and perform as fully and largely, in respect to all intents, constructions and purposes, as I my self might or could do, if I were there in my own person present, ratifying, allowing, and holding firm and stable all, and whatsoever my said Attorny, shall lawfully do, or cause to be done in or about the Execution of the Premises, by virtue of these. In witness whereof, &c.

A Copy of a Will.

IN the Name of God, Amen. The 12*th.* day of *Septemb.* 1693. according to the computation of the Church of *England*, I (*W. W.*) of —in

——in the County of ——Gent. being weak of Body, but of found and perfect Memory, thanks be to God: Therefore do make, ordain, and conſtitute this my laſt Will and Teſtament in manner and form following.

Firſt, I bequeath my Soul into the hands of Almighty God my maker, hoping to be ſaved by the meritorious Death and Paſſion of Jeſus Chriſt my only Saviour and Redeemer, and as for my Body to be buried in Chriſtian burial, at the diſcretion of my Executor hereafter named.

Item, I give to———

Item, I give to ——

All the reſt of my Houſes, Leaſes, Lands, Tenements, and Goods whatſoever, I give unto my Eldeſt Son *Q.* and his Heirs for ever, upon condition, that he ſhall pay all my Debts and Legacies, and make him ſole Executor of this my laſt Will and Teſtament, revoking and diſannulling all other Wills and Teſtaments whatſoever; this only to be taken as my Laſt Will and Teſtament. In witneſs whereof I have hereunto ſet my Hand and Seal the day and month above-written.

An Acquittance in full.

REceiv'd of (*T. D.*) the ſum of—— pounds of lawful mony of *England*, in full diſcharge of all Debts, Reckonings, Accounts, and Demands whatſoever, from the beginning of the world to this day, being — the ——day —— In witneſs whereof I have hereunto ſet my hand and ſeal.

Sealed and delivered in the preſence of

A Receipt upon Receiving of money.

September 13. 1693.

REceiv'd of (*A. M.*) the sum of Five Pound in part of payment of a Bill of work due to me from (*A. M.*) I say Receiv'd

ll.	*s.*	*d.*
05	00	00

per me W. N.

An Indenture of an Apprenticeship.

THis Indenture made the—— day of—— in the year —— in the —— year of the Reign of——King of *England*, *Scotland*, *France* and *Ireland*, King Defender, &c. witnesseth, That (*E. B.*) Son of (*I. B.*) late of —— of his free and voluntary will, hath put himself Apprentice to (*R. W.*) of the Parish of —— and with him after the manner of an Apprentice to dwell and serve from these present —— unto the full end and term of —— the said Apprentice the said (*R. W.*) well and truly shall serve, his secrets shall keep close, his commandments lawful and honest every where he shall gladly do, hurt to his said master he shall not do, or suffer to be done to the value of twelve pence, or more by the year, but shall let if he may, or else immediately admonish his said Master thereof. The Goods of his said Master he shall not inordinately waste, nor them to any body lend. At Dice, or any other unlawful Game he shall not play, whereby his said Master shall incur any hurt. Fornication in the the house of his said *master*, or elsewhere, he shall not commit. Matrimony he shall not contract. Taverns he shall not frequent. With his own proper Goods, or any bodies else, during the said term, without the special License of his master, he shall not mer-

merchandize. From the ſervice of his ſaid maſter day or night, he ſhall not abſent or prolong himſelf, but in all things as a good and faithfull Apprentice, ſhall bear and behave himſelf towards his ſaid maſter and miſtreſs, and all his, during the term aforeſaid—and the ſaid (*R. W.*) to his ſaid Apprentice the Science or Art which he now uſeth, ſhall teach and inform, or cauſe to be taught and informed in the beſt way that he may or can, and alſo ſhall find to his ſaid Apprentice Apparel, Meat, Driuk, and Bedding, and all other neceſſaries meet and convenient for an Apprentice, for and during the term aforeſaid.

Sealed and delivered in the preſence of

A Deed of Gift.

TO all people to whom this preſent writing may come, I (*B. C.*) of —— ſend Greeting, *&c.* Know ye that I the ſaid (*B. C*) as well for and in conſideration of the natural affection and love I bear unto my well-beloved (*P C*) of —— as alſo for divers other good cauſes and conſiderations me at this preſent eſpecially moving, have given, and granted, and by theſe preſents, do give, grant, and confirm unto the ſaid (*P C*) all and ſingular my Goods, Chattels, Leaſes, Debts, ready Monys, Plate, Jewels, Rings, Houſehold ſtuff, Apparel, Utenſils, Braſs, Pewter, Bedding, and all other my Subſtance whatſoever, movable and immovable, quick and dead, of what kind, nature, quality, and condition ſoever, the ſame are, or be, and in what place or places ſoever the ſame be, ſhall or may be found as well in mine own cuſtody or poſſeſſion, as in the poſſeſſion, hands, power,

power, or custody of any other person or persons whatsoever, to have and to hold all and singular the said Goods, Chattels, Leases, Debts, and all other the aforesaid Premises, unto the said (P C) his Executors, Administrators, to his and their own proper uses and behalfs for ever, freely and quietly without any matter of challenge, claim, or demand of me the said (B C) or of any other person or persons whatsoever, for me and in my name, by my cause, means, or procurement, and without any mony or any other thing therefore to be yielded, pay'd, or done unto me the said (B C) my Executors, Administrators, or Assigns; and I the said (B C) all and singular the aforesaid Goods, Chattels, and Premises, to the said (P C) his Executors, Administrators, and Assigns, to the use aforesaid, against all people do warrant, and for ever defend, by these presents. And further, know ye, That I the said (B C) have have put the said (P C) in peaceable and quiet possession of all and singular the aforesaid premises by the deliveriug to him at the sealing hereof one coined piece of silver, commonly called two pence, fixed on the Seal of these Presents.

Sealed and delivered in the presence of

MUSEUM
BRITAN
NICUM

ERRATA.

THE Authors Absence from *London*, has occasion'd some Errata, which the Reader is desired to Correct, as follows.

Pag. 3. l. 4. and 5. for 10. 20. 30. 40. 50. r. 11. 12. 13. 14. 15.
p. 20. l. the last. r. 18. 11. r. 19. &c.
p. 40. l. 15. f. 1728. r. 1768
p. 48. l. 10 for *so* r. too
p. 62. after l. the last r. your Answer on (6).
p. 73. l. 9. for 10. read 2.
p. 78 l. 8. r. 900. read 600.
p. 79 l. 19. for one read the.
p. 80 l. 12. for 24. read 12.
p. 82. line 14. for 41 read 44.
page 85. line 20. for ten read 2.
page 95. l. 10 for *to* read do.
page 113. line 15. for 1 *instead* r. 3. instead.
page 116. line last for *Rafter* r. Ratters.
p. 117. l. 13. *Steeper* r. Sleeper and in all other places.
page 120 line 17 for *when*, read as.
p. 125. l. 17. f. *Stair Strings*, r. Stair Strings.
page 130. line 18. for *via*, r. Leg.
page 131. line 21 for *Scale*, read Call.
page 133. line 5. for *Scale* r. Readily.
page 138. line 17. for 20. *f.* read 20 *s.*
page 139. line 18. f. 5. *f.* read 5. *s.*
page 143 line 3. for if 25. read if 23.
page 144. line 10. for *Moth* read Month.